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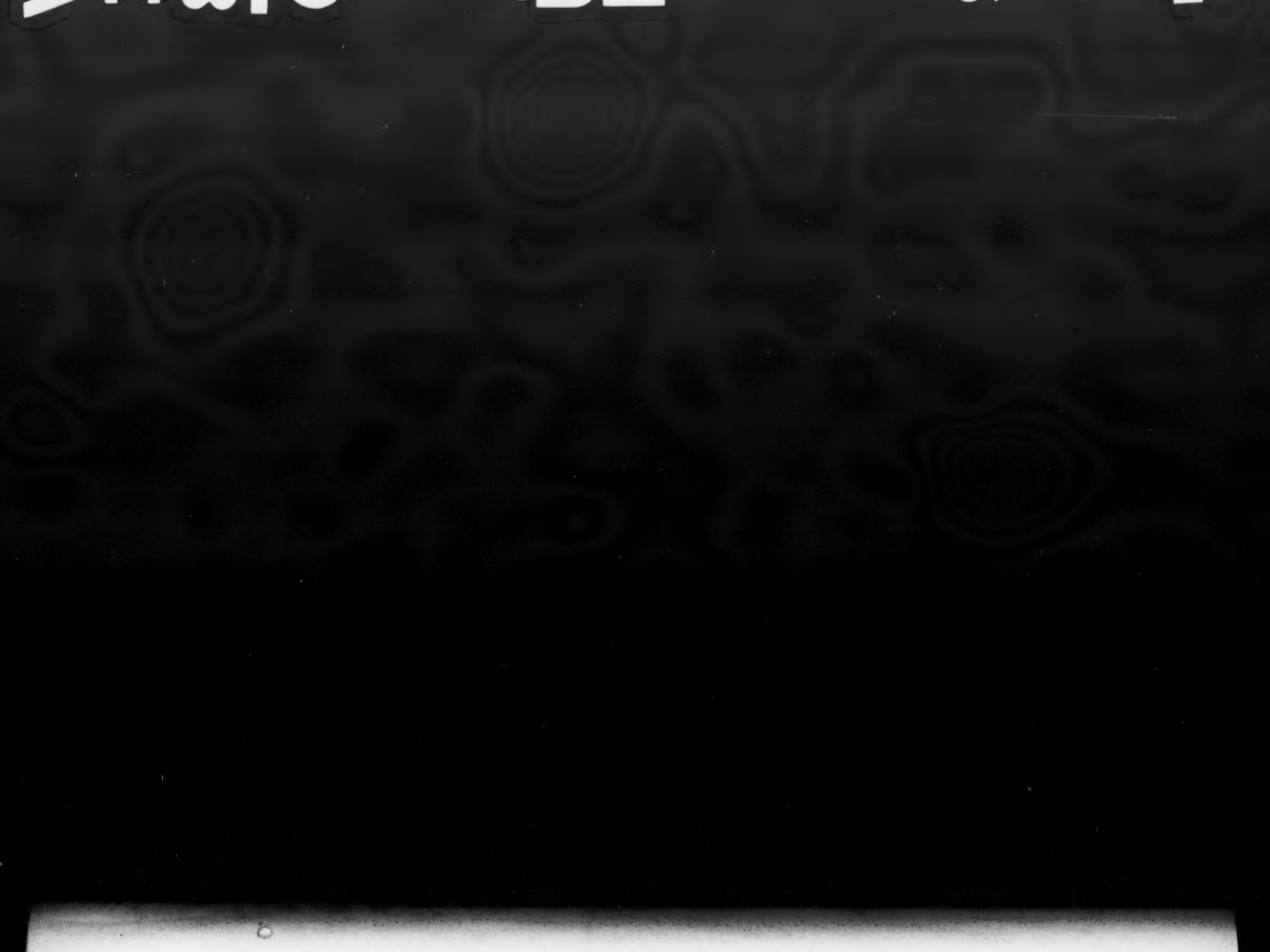

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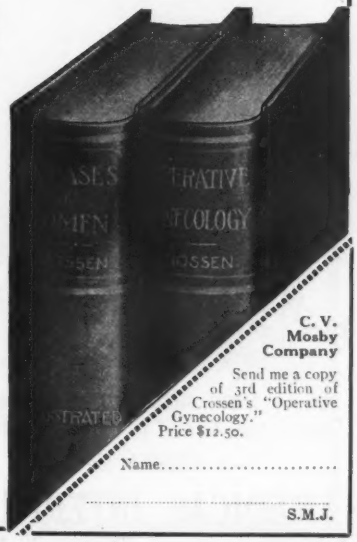

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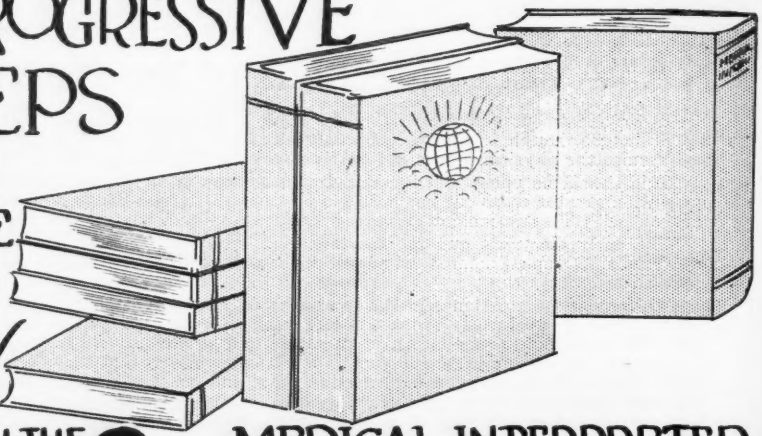

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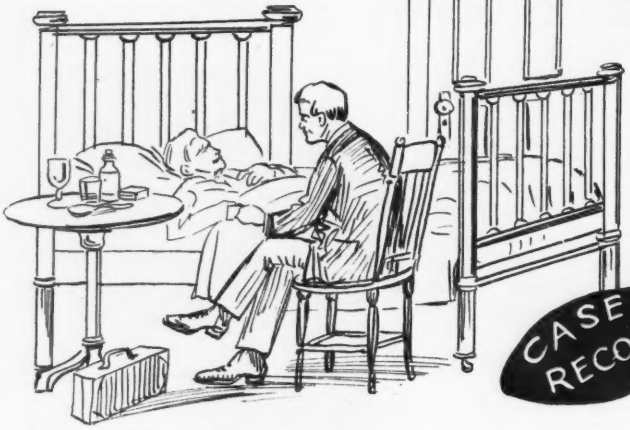

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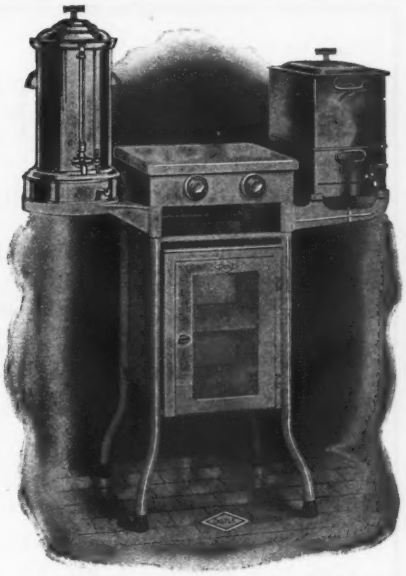

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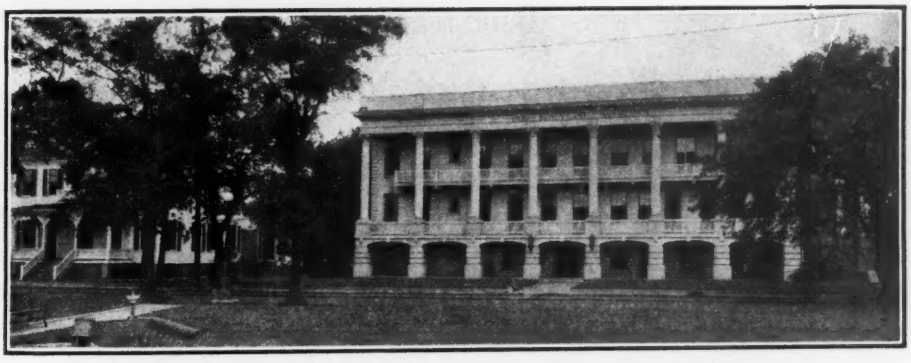

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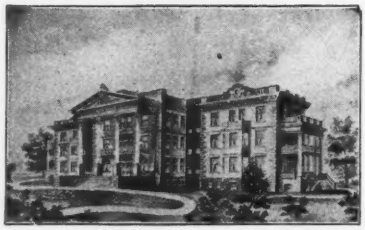

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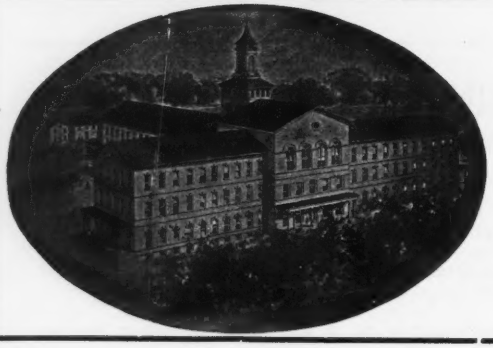

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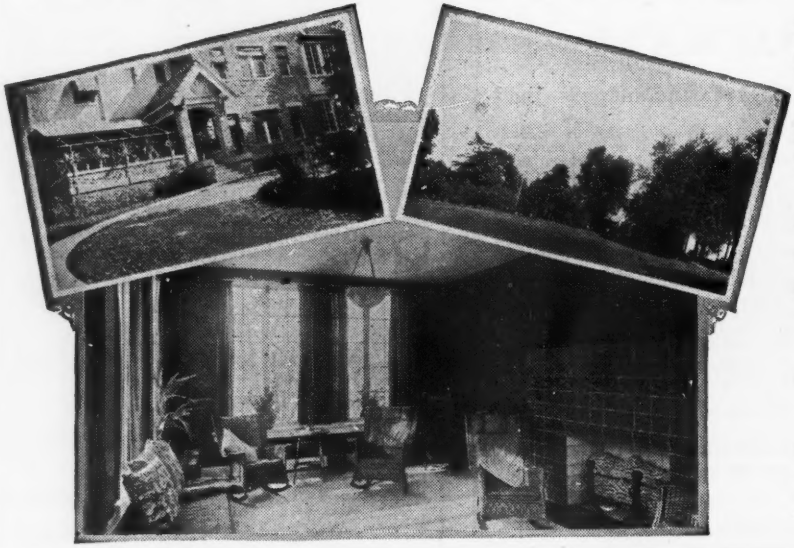

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MEDICINE

INTERNAL DISEASES, PEDIATRICS, NEUROLOGY, DIAGNOSTIC METHODS, ETC.

TISSUE CHANGES FOLLOWING RADIUM AND X-RAY THERAPY*

By H. R. WAHL, M.D.,
Kansas City, Kan.

In the study of the x-ray and radium the changes occurring in the tissues have been of fundamental importance. They are taking a more practicable and clinical aspect since the introduction of "deep therapy." However, there is so little knowledge and so little uncontroverted scientific opinion of how and why these rays act that there is a dangerous tendency even among well informed medical men to encourage the use of these physical agents in the treatment of a great variety of diseases with "miraculous" results. This tendency is apt to jeopardize the real value of the x-ray and radium unless their use is controlled by intensive scientific study of the basis of their action and of the effect of their rays upon the tissues exposed to them.

The way in which the actinic rays act is subject to much difference of opinion. Some maintain that they have a direct deteriorating effect upon the cells involved. Others hold that the action is primarily upon the endothelium of blood vessels resulting in obliteration of the blood supply and consequent lack of nutrition in the tributary areas, and, recently much evidence has been furnished that indicates that the action is an indirect one through the stimulation of protective substances by the normal tissues. It is probable that all three theories, direct action, vascular obliteration and indirect action are concerned in producing the changes. But which is the most important fact and why, are questions still undetermined which if answered, will place this therapy on a much more scientific basis.

Another concept that has suffered considerable criticism is the generally accepted statement that the x-ray has a selective action on cells. It is stated that the effect is particularly upon young cells especially during the process of nuclear division. Yet, it should be remembered that such young cells are much more easily injured by any physical agent such as heat than more adult forms. Some workers go so far as to deny a selective action on the part of these rays. Yet the effect of the x-ray does show a great variation in different tissues whatever the basis of their action may be. This is particularly important in deep therapy, because when such exposures are made it is evident that three groups of tissues are involved: first, the tumor or lesion; second, the tissues transversed by the rays in reaching the tumor, and third, the circulating blood. When the treatment is prolonged the entire circulating blood is exposed.

The lymphoid cell in the blood is most easily affected and is reduced in number though with therapeutic doses this lymphopenia is not striking. Lymphoid cells generally are easily destroyed and pathological conditions such as Hodgkins' disease, leukemia and lymphosarcoma rapidly melt away after radiation, though a permanent recovery is rare. There is some question as to whether this susceptibility of lymphoid tissue is not a contra-indication to radiotherapy of a tumor, especially if MacCarty's contention that the lymphoid cell is important in maintaining the body's resistance to tumor cells is correct.

*Read in Section on Pathology, Southern Medical Association, Eighteenth Annual Meeting, New Orleans, La., Nov. 24-27, 1924.

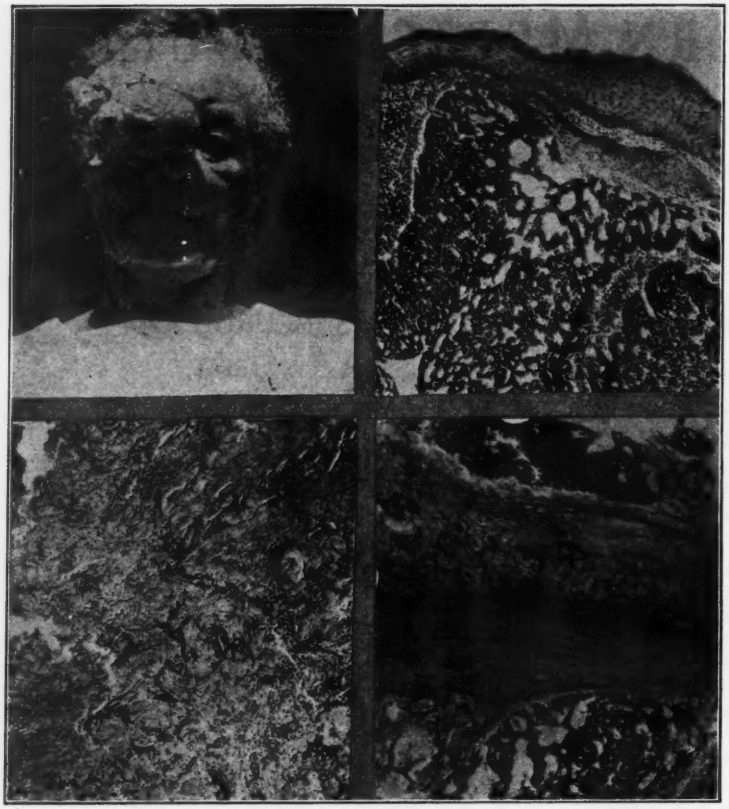

Fig. 1. (Top left).—Colored patient with carcinoma of face of eight years duration. No glandular enlargement.

Fig. 2. (Top right).—Photomicrograph of the above tumor showing its histological character. Mag. 70X.

Fig. 3 (Bottom left).—Photomicrograph of the above tumor two months after combined x-ray and radium treatment. The main tumor had melted away leaving a persistent indurated ulcer the edge of which is shown in this illustration. Note a few degenerated hyperchromatic cords of tumor cells.

Fig. 4. (Bottom right).—Photomicrograph from an enlarged cervical gland that was removed nine months after section in Fig. 3 was removed. Note the same general appearance as in Fig. 2. Mag. 70X.

The germinal epithelium has long been known to be especially susceptible to the x-ray, repeated cases of sterility following x-ray therapy for uterine cancer, especially in the early days when its use was not so well controlled.

Following the use of deep therapy frequent cases of "x-ray sickness" have been reported and have often become very serious. Recent developments in the study of tissue changes have shed considerable light upon this complication.

Warthin has recently described striking focal inflammatory lesions involving the bile ducts and believes the "x-ray sickness" to be of hepatic origin. Whipple has shown that the intestinal epithelium is markedly injured by deep therapy, and believes that these intestinal lesions cause a toxemia similar to the proteose intoxication or high intestinal obstruction and that they cause the x-ray toxemia. Holfelder and Peiper have recently shown that the adrenal gland is twice as sensitive as the intestinal epithelium and that in deep therapy the adrenal glands show marked degenerative changes especially in the cortex. They explain the roentgen malaise following gastric irradiation to transitory injury to the suprarenal capsule. Davis' recent work on intrathoracic changes following deep therapy of chest lesions emphasizes the danger of pulmonary and pleural lesions from prolonged treatment of carcinoma of the breast with the x-ray. Other tissues are not seriously affected and the changes produced do not merit discussion in a short paper.

The effect of x-ray and radium upon tumors affords their greatest therapeutic application but the changes are very variable depending upon the amount of exposure, the nature of the tumor, its location and the susceptibility of the individual. While the changes occurring follow a general course they are so variable in different tumors that only a sketchy account of the effects upon a specific type of tumor under the influence of one large exposure can be given.

The cells of a squamous cell carcinoma pass through five successive phases before their ultimate disappearance: first, the latent phase oc-

Fig. 5.—Photomicrograph of epithelioma over right eye. Treated two years ago with radium and violet ray. Apparently healed and then broke down again. Has enlarged in spite of repeated radium treatment in past four months. Note the absence of tumor cells near the surface and the nests in the deeper tissues. Also the obliteration of the vessels. Mag. 70X.

curring four to fifteen days after exposure. In this period there is hyperemia, some hemorrhage and beginning exudation of lymphocytes and polynuclears. The cellular changes are negligible.

The second phase is the development of monstrous characters in the cell. All parts of the cell may be enlarged. Often the cells are loosened, scattered diffusely or may be fused together into multinucleated giant cells. Nuclear changes are often prominent and consist in swelling, loss of structure, increased intensity of staining, pycnosis or disintegration. Large hyperchromatic forms are especially common. The mitiotic figures are often atypical and usually infrequent. The cells often contain bodies of a pseudo-parasitic character. The cytoplasm often has a foamy appearance. This stage occurs usually two or three weeks after exposure.

The third stage is that of excessive keratinization which is often variable in amount and distribution.

This is followed by disintegration and phagocystosis associated with degeneration and disappearance of the tumor cells. This is caused by the leukocytes and fibroblasts which are usually active and becomes marked in four weeks after exposure. The tumor cells are soon reduced in number and often occur in small nests here and there, separated by increasing masses of stroma. Macrophages and plasma cells often accumulate about the vessels remaining long after the disappearance of the tumor cells. Pycnotic nuclear fragments and occasional granules and agglutinated masses of chromatin may be all that is left of the tumor tissue. The stroma often shows a fine fibrillar structure with basic staining and a mucinoid appearance.

The final phase is the formation of scar tissue. The stroma is usually active, leukocytes are numerous and with the development of new capillaries and fibroblasts lead eventually to a peculiar cellular type of granulation tissue replacing the tumor tissue. This in turn may be replaced by old hyaline fibrous tissue. An obliterative angiitis is often described especially with excessive exposures but is not a constant finding. Whether a distorting scar or a persistent non-healing ulcer results finally depends largely on the proper dosage. Often with improper dosage a persistent ulcer may still develop and eventually give a recurrence. Occasionally the development of capillaries becomes abnormal and an angiomatous or telangiectatic

Fig. 6.—Photomicrograph of epithelioma of lower lip of six months duration. Has had 17 radium treatments. Note the marked hyperchromatism of the cells and their tendency to fuse together. Mag. 170X.

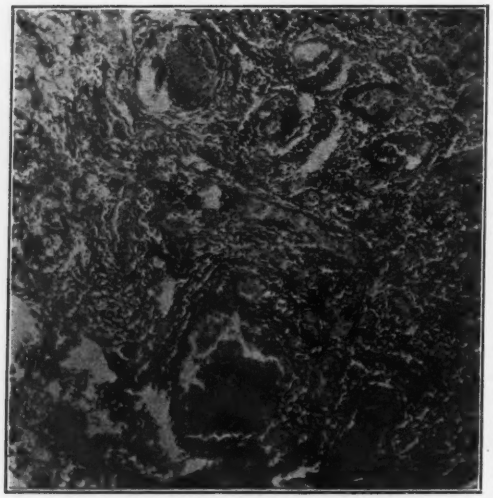

Fig. 7.—Photomicrograph from same case as in Fig. 6, but from a different field. Note the capillary ectasia, the inflammatory reaction and degenerating cords of tumor cells. 80X.

change develops, especially if only the surface of the tumor has been affected.

The matter of correct dosage is of the greatest importance and yet is very difficult to determine. No positive rules can be made. Some tumors persist in spite of the most carefully adjusted doses. Tumors having the same histological structure may react differently. Even cells in different parts of the same tumor vary in their susceptibility to the x-ray. Just as there is marked variation in histological appearance in different and even in the same malignant tumor so are there similar variations of x-ray sensitiveness. Hence, certain tumor cells may survive the exposure and develop a new strain of cells resistant to radiation regardless of its amount and lead to progressive growth of the tumor in spite of radiation. This is nothing but an illustration of a general biological phenomenon in which a chemical or physical agent acts on masses of living organisms or cells. The same process results in the development of the so-called arsphenamin-fast spirochetes in some cases of syphilis. Schwartz noted a difference in the behavior of benign and malignant tumors to repeated doses of x-ray and radium, the former showing increasing susceptibility to the rays while the latter manifest a progressive increase in resistance.

It is probable that in x-ray therapy two cellular reactions occur: one which is non-specific but destructive acting upon the younger cells of the tumor and the other which has a specific stimulating action causing an increase of the natural body defenses which indirectly act on cells that have resisted the direct action of the x-ray. To secure the maximum therapeutic effect the dose must not be too large or too small. It varies with each individual case. In its determination the roentgenologist deals with four factors only one of which is stable while the other three are biologic variants. He is sure only of his x-ray technic. The biological variants are the individual patient, the nature of the tumor and its location. The only way in which he can be certain of the nature of the tumor is by examination of a biopsy specimen, yet it is very rare that this is done. The roentgenologist must know the anatomic relations, the histologic structure and natural history of the growth and its possible secondary complications as well as the physical condition of the patient before he can intelligently use the x-ray and radium and do justice to both his patient and radiotherapy. Until a more thorough knowledge of the natural history of tumors is associated with x-ray treatment than there has been in the past, one cannot determine just when x-ray therapy is indicated and when it is not.

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DISCUSSION (Abstract)

Dr. H. E. Robertson, Rochester, Minn.—Radium and x-ray probably vary in the sensitiveness of their effect in individual cases. Irreparable harm may be done to various internal organs, particularly the lungs, liver, kidneys and adrenals by radiation. More work is

needed along the line of this paper before our knowledge will become sufficiently systematized.

Dr. C. L. Martin, Dallas, Texas.—The practice of radiology is almost an uncharted sea and we have been supplied with a great deal of erroneous data, not necessarily from the pathologists but from radiologists across the water; and a great deal of this sort of work which is done by the physiologists and pathologists in connection with us needs further study.

At the hospital in Dallas we have taken isolated portions of the small intestine of dogs and have treated them so that later on there was definite radium action, which is described in the literature. This does not come on for one or two months after the treatment in many instances, and yet it is due to the effect of the radium. We are now trying to work out the effect upon the adrenal; and while we are not ready to report on it, we rather believe that the reports from across the water are not correct. We have removed one adrenal from an animal and isolated the other organs from the field and the animals rayed in this way have remained well for many months. In one case we found a complete absence of the medulla of the adrenal, only scattered remnants of the cortex, and yet the animal was in perfect health when it was sacrificed.

Dr. Stuart Graves, Louisville, Ky.—I wish to call attention to the stimulation of tissue by deep x-ray therapy. I have in mind a case of what was a typical leiomyoma which was treated with deep x-ray in massive doses. About six weeks after this treatment the tumor underwent a very rapid growth and the woman died. Post-mortem examination showed extensive infiltration of the leiomyoma. No metastases could be found, but a very rapidly growing tumor with large areas of undifferentiated smooth muscle cells. All that might have been a coincidence and similar coincidences have been noted, but it is worthy of attention.

Dr. Wahl (closing).—In my paper I took particular pains not to find any fault with this therapy in treating disease. The point I wish to emphasize is not to do the work without having it controlled. In my part of the country tumors are being x-rayed right and left without knowledge of their exact nature. Before any one treats a tumor he should have a biopsy done. That will give one of the four uncertain factors that determine the size of the dose. I have heard men say that there is danger of stimulating the tumor by taking a piece out. Except in a few rare cases I think that is exaggerated. I know several men in the country who are in the habit of doing this constantly and they have never found any evidence that the tumor growth was stimulated by removing pieces for histologic examination. I wish to make a plea for this kind of work; for there is a great deal of difference in the reaction of these tumors to dosage, depending upon the nature of the tumor. The dosage should be adjusted to fit each individual case.

THE LARGER VIEW OF HEART DISEASE*

By STEWART R. ROBERTS, M.D.,
Atlanta, Ga.

A senior student can with reasonable accuracy discover a mitral incompetency or an aortic stenosis. An intern can, with reasonable accuracy, discover a heart block or an auricular fibrillation. Either of them can give evidence regarding hypertrophy and dilatation. A roentgenologist can accurately ray the heart and measure its various diameters, and even a technician can reasonably conclude concerning any marked hypertrophy. A simple fluoroscopic examination of the chest will usually prove the presence or absence of aneurysm. The subjective pain and discomfort of the patient give evidence of angina pectoris. The testimony of the patient, his appearance, exercise tests and the spirometer give valuable evidence concerning the functional efficiency of the myocardium. The polygraph and the electrocardiagraph permit a finer analysis. The diagnosis of heart disease has reached a degree of thoroughness hitherto unknown and impossible.

The scientific study of the circulation in the modern sense may be said to have begun when Harvey published the result of his researches. Thatcher in his first American Practice says of this discovery: "Of all the transactions recorded in medical history, this is incomparably the most essential in its effects and consequences." Boerhaave, the Dutch clinician and teacher, said that Sydenham always bowed his head at the mention of Harvey's name. Withering published his work on "Digitalis" in 1785, but the remedy does not seem to have been used in America until several years later. Moore, of Philadelphia, seems first to have written of it in 1800. Laennec and his stethoscope began the accent on murmurs and there seems to be a skip of nearly eighty years before McKenzie began the clinical accent on the heart muscles as the source of the heart's kinetic energy. McKenzie also proved the truth of Withering's directions for giving digitalis and introduced the study of the mechanism of the heart beat and its irregularities. The older clinicians had referred to the irregularities of the pulse as the "skipped beat, delirium cordis, and the pulsus irregularis perpetuus." They had not attempted explanation.

The study of heart disease is really a recent

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effort of science. Allan Burns, in 1809, published the first book on heart disease. W. C. Wells, of Charleston and London, in 1812, first called attention to the relation between rheumatism and heart disease. The fetal heart sounds were not heard until 1818. Richard Mead, the first clinician of his day, in the last edition of his works published in 1775, devoted slightly over one page to diseases of the heart. Latham classified endocarditis as independent of and as associated with rheumatism, and glibly wrote that endocarditis never kills. Covisart, Hope, Stokes, Latham, and Flint, were students of signs and symptoms. Each one added something to the knowledge of heart disease, and yet the unknown science of bacteriology and instruments of precision were needed to explain many puzzling clinical phenomena.

Cellular pathology, bacteriology, and biological chemistry have been the three avenues to the laboratory period of medicine. In this period it is probably true that medicine as a science has developed more than in all previous civilization. It was therefore but natural that the heart should be approached with greater preciseness from the laboratory point of view. Among the contributions from the laboratory may be mentioned Bowditch's discovery that the contractions of the heart are all or none. Gaskell, in 1881, demonstrated the innervation of the heart to be the same in cold and warm blooded animals. He noticed that the wave of contraction proceeds from the area of the sinus venosus and proved that the nerve supply to the heart controls the rate but does not originate the contractions. Here is the primary fact that the heart muscle is itself automatically rhythmic and contractile.

He also introduced the term "heart block" and produced it experimentally. His junior, in 1893, discovered the sino-auricular node or "pacemaker." McKenzie developed the polygraph, and in 1903 Einthoven the string galvanometer, the electrocardiograph of today. Thomas Lewis first introduced the term "auricular fibrillation," though McKenzie had previously studied the condition. George Draper in New York, working with G. Canby Robinson, first introduced the term "pulse deficit" to express the difference between the apex and radial rates in fibrillation. The studies of the heart continue in all countries and more articles are published on the circulation than on any other system. Completeness of knowledge on any subject is probably impossible, but certainly a thorough working knowledge of the heart has been accumulated.

The physician is naturally interested in the causes of disease and the causes of death. The outstanding fruition of the last fifty years of medicine is the increase in the length of the average life from 35 to 58 years. The average length of life of union workers increased in the last 23 years 18 years and 8 months per life. In New York City in 1868, the mortality rate was 29.25 per 1,000; in 1921, 11.17 per 1,000. The prevention and cure of acute infectious diseases, the wider range of a scientific surgery and a scientific sanitation are the chief influences. Typhoid fever, yellow fever, and diphtheria are nearly blotted from civilization, and yet heart disease is on the increase. Organic heart disease is today the greatest cause of death. No more could John Bunyan call tuberculosis the "Captain of the men of death," and no more could Osler apply the title to pneumonia.

On the average, one death in every ten is due to tuberculosis, and one in every six to heart disease. In the registration area in 1922, heart disease caused 134,184 deaths; kidney diseases 78,312; cancer 78,355; cerebral hemorrhage 76,538; pulmonary tuberculosis 75,905; and lobar pneumonia 45,171. Heart disease in New York City kills three times as many as tuberculosis, more than twice as many as cancer, and more than half again as many as pneumonia. It is estimated that 150,000 persons die of heart disease in the Republic annually.

It is estimated that 75 per cent of aortic insufficiency is due to syphilis. Tonsillitis, rheumatism, and chorea are probably responsible for 60 per cent of chronic heart disease. On the average, 2 per cent of industrial workers, school children, and insurance applicants have cardiac lesions. At the University of Georgia, in three years, of 1762 students examined, 102, or 6 per cent, had organic heart disease. Four per cent of the draft, or one young man in every 25, had heart disease. One in fifty is the estimated frequency, but it must be far higher if it is one in twenty-five for the younger men. Georgia averages approximately three thousand deaths per year from this cause. The deaths in 1922 in Syracuse were 18.7 per cent, in the registration area 21.1 per cent, and in New York State in 1923, 20.3 per cent. In these statistics heart disease averages one in five as a cause of death. In 865 heart deaths in Cincinnati, 2.5 per cent were under 20 years, 13 per cent from 20 to 45, and 85 per cent over 45 years. The sharp advance in mortality seems to come at 45 years. The draft gives the best index of the total number of cardiacs, and the

number in the states may be estimated at from two to four million.

An organic cardiac probably suffers on the average with a 50 per cent reduction in expectancy and efficiency. Diseases are important as they numerically kill, maim, or cause suffering. It is probable that there are more deaths annually from heart disease in Minneapolis than there are cases of encephalitis annually in the Republic. The problem is more than one of statistics and pathology; it is social and economic as well. It particularly strikes at the worker whose wages alone are his fortune: with him more and more exhaustion at the close of the day's work, a little dragging behind his fellows, attacks of decompensation, increased hospital expense to the city or state, or worse, no hospital facilities, lessened income in the family, long drawn out sickness and suffering, and the inevitable end.

With of course exceptions, from infancy to 40, is the time of the rheumatic group, focal infections, and the infectious diseases; from 40 to 55 syphilis is the chief offender, and after 55 degenerative changes. The younger the patient, the more sensitive the valve to this obscure infection of climate and exposure that is called rheumatism. Bacteriology is too young and the doctrine of focal infections too embryonic to permit dogmatic statements concerning either. The doctrine of focal infections is probably America's greatest contribution to medicine and along this path somewhere probably lies the cause and prevention of the rheumatic group and the reduction by 60 per cent in endocarditis, valvulitis, and organic heart disease. The remedy for valvulitis is not cure, but prevention en masse. The damage from syphilis on the heart and vessels will continue as long as society tolerates venereal disease. There is no more reason for a citizen to have syphilis than there is for him to have leprosy. The degenerative diseases come with age, but they are hastened by unwise eating, drinking, smoking and neglected hygienic measures.

Certain problems naturally present themselves here to the thoughtful internist. Prevention is of two kinds:

(1) To prevent any damage to the heart further than that incident to growing old naturally. To prevent heart disease and stop this greatest of the funerals of present day pathology, we must begin with the child.

(2) Prevention involves care of the already damaged heart that there may be no further damage.

Here clinical observation and clinical obedience are necessary. Everything that lives sooner or later dies. Every myocardium must sooner or later exhaust its contractile power. The infected heart, the poisoned heart, and the degenerated heart are but simple names for the different processes which before its natural time, weaken the myocardium and lessen its contractile power. There is more to medicine than just medicine. The surgeons are exerting every influence to fight cancer, and even the lay public is aiding gladly. Diagnosis and therapeutics have been our head and hands and we internists may well begin to use our medical feet and walk more securely and usefully in the paths of preventive medicine. Certain questions of prevention arise here.

(1) Does the removal of the tonsils in the young child lessen the frequency of the rheumatic group? The child is the chief treasure of preventive medicine.

(2) Does careful attention to the teeth and dentition of children lessen the danger of focal infection?

(3) An appointment by the proper sources of a medical commission to study the rheumatic group with regard to etiology, relation to focal infections, cure and prevention, would systematize our knowledge of the subject and prove practical as well.

(4) Has not civilization had enough of syphilis? Is it not primarily a question of prevention rather than one of attempted cure? Is not a disease with such potential promise of damage a proper subject for all the forces of preventive medicine and stringent action by the public health agencies?

(5) The cardiac should work. All too often he must work. Changes of occupation may be considered as well as digitalis. Week-end rests in bed at home from Saturday noon to Monday morning lessen the cardiac strain.

(6) Has not internal medicine to get down to the level of the citizen's daily life and advise the ignorant, the foolish, and the wicked, as well as the wise, concerning food and raiment, sleep and sex, exercise and stimulants, as well as disease? Do we practice and think above the level of our patients?

(7) Why wait till one gets sick, particularly an adult? Would it not be wise for the physician to establish with the approval of the profession, a fee for the thorough examination of an apparently well man, and then a nominal fee for the yearly examination of that man? The

locomotive is inspected and repaired at the end of every day's run. Is not the citizen entitled, and should not the profession insist, that he have an inspection at the close of every year's run?

(8) Every large railroad and industry should have an internist to look after its organs as well as a surgeon to look after its wounds. Fifty million Americans work and ten millions of them are in industry.

(9) Each state should have a state general hospital where the rural poor can be treated, and where more attention can be given to the prevention and cure of chronic diseases. The profession should not be taxed with this great mass of pathology without the resources of a hospital. The state has obligations of hospitalization as well as the municipality. Massachusetts, Maine, Michigan, Iowa, Nebraska, and Oklahoma could well be followed in this regard.

(10) Science and medicine have well attacked the acute infectious diseases. Vaccinate and there is no smallpox. The problem of heart disease is far more complex. The task of properly studying and preventing the cardiac is before us.

DISCUSSION (Abstract)

Dr. Bryce W. Fontaine, Memphis, Tenn.—Dr. Roberts gives the credit of the "all or none" law of the heart to the Germans, whereas it was Bowditch, of Harvard, who first called attention to it.

The main points in this paper are most timely, inasmuch as cardiovascular diseases are heading the mortality lists in this country at the present time; and it behooves us to take steps toward their prevention, as well as cure.

Dr. S. W. Welch, Montgomery, Ala.—In this discussion you disclose the fact that the great medical profession of America is looking only at the heart. Fifty-two per cent of those hearts are not hearts but syphilis; twenty-five per cent are not hearts but focal infections, all of which might have been prevented by instrumentalities supplied by knowledge of disease control methods of today. When I first came in this afternoon I was particularly attracted by the large crowd here, which demonstrates that the medical profession is more interested in the individual and the interests of the individual than it is in the interests of the group and mass control. But there is where our chief service to our day and generation lies. It is for you to get behind your health organizations in your several states and bring them up to a higher degree of perfection so that they may cope with these diseases and prevent them from occurring. Seventy-five per cent of these disasters should not have befallen our fellow citizens.

Dr. A. E. Fossier, New Orleans, La.—With all the advance made in the science of cardiology and the rapid strides in the diagnosis of cardiac diseases during the past few years there is still a most important question that remains unanswered. And that is, what is the size of the normal heart of an individual?

Dr. Roberts asserts that this question has been answered by the radiologist. Unfortunately in determining the size of the normal heart radiology is of little value, and the physician who must rely absolutely on the roentgen rays to map out for him the area, or to measure the size of the transverse or longitudinal diameters of that organ, will frequently be given data that will lead him into error. The size of the transverse or longitudinal diameters, or the same area of the cardiac silhouette, prove nothing and mean little in recognizing the normality, or any slight but significant enlargement of that organ, until a basis for determining the normal size of the individual heart be established.

The recent monumental work on the roentgen determination of the size of the individual normal heart by Groedel, Vaquez and Bordet, Claytor and Merrill, Bardeen, Hodges and Eyster, and many others, has resulted in the same indefiniteness as a century ago clouded the historical anatomical observations of these pioneers of cardiology, Laennec, Cruveilhier, Corvisart and Bouillaud.

The radiologists of today must agree with the statement of Laennec made over a hundred years ago, that it is impossible geometrically to indicate the size of the heart in a normal individual.

I have come to the conclusion that there is only one criterion by which it is possible to determine the size of the normal human heart, and that is by comparing it with the size of the clenched fist. The transverse diameter of the heart corresponds to the linear measurement of a line beginning at the juncture of the inner side of the clenched fist and the wrist, and ending at the middle joint of the fourth finger. As the most important diameter of the heart is the transversal, it is the one used in comparison with the fist.

I have published the results of my experiments in the issue of June 21, 1924, of the *Journal of the American Medical Association.*

Dr. D. C. Walt, Little Rock, Ark.—Heart disease is always secondary. Every individual needs daily care as to drainage of the bowels. We drain from necessity more than from requirement. Every one's bowels should move well every three hours, and never less than every four hours when awake. No one should eat meat in this country, and cereals and eggs should be eaten only when needed. I have not eaten two pounds of meat or bread or eggs in twenty years. I never weighed over 150 pounds before I began caring for myself—I now weigh 176. No one, regardless of his intelligence, gets the care to maintain health that the lower animals do under certain conditions. We should attempt to keep good health rather than only correct bad health.

Dr. L. J. Moorman, Oklahoma City, Okla.—In spite of the development of our knowledge of cardiac disease, cardiac disease stalks ahead as a cause of death and has taken the top round of the ladder. This is contrasted with the history of tuberculosis, which on account of improved environment and living conditions has receded as a cause of death. We cannot look to this improved environment and living conditions to aid us in the prevention of cardiac disease, and while we wait to discover some preventive measure we must pay particular attention to the second phase of prevention

which Dr. Roberts mentioned in his paper, the management of cardiac disease after it has developed.

This, it seems to me, should consist of periodic examinations, not only in the adult but from infancy to old age with the view of discovering possible sources of infection and eliminating them. After all, our chief obligation to our patients suffering from chronic conditions, particularly this one, is an educational one. We must come down on a level with the patients as individuals and determine what their living conditions are, under what strain they may be laboring and alter these conditions according to cardiac needs.

Dr. L. W. Roe, Mobile, Ala.—It is of utmost importance that an individual with a deficient heart be guided correctly and be kept within safe limits of his heart's load. To be able to forecast his longevity can only be brought about by more intimate study of the heart's behavior.

Dr. Allan C. Eustis, New Orleans, La.—When we realize that the doctrine of focal infection is practically new and that the radical and scientific treatment of syphilis is practically new, we can venture to prophesy that in the next decade the incidence of cardiac disease will be much less than at present.

I have been particularly interested in the recognition of failing heart muscle in the apparently healthy individual. An idea was developed by Dr. Frost in a paper delivered before a meeting of insurance companies, to the effect that a murmur means nothing unless the heart muscle is failing. He has a test whereby the positive pressure exerted on the heart can be definitely determined, the individual taking a deep inspiration and expiring against a pressure guage at five pounds to the square inch. The blood pressure of a normal individual will drop on this positive pressure about 20 millimeters. By having the patient breathe his full vital capacity three times, recording systolic blood pressure after each time, the latter will mount 30 to 90 millimeters above normal; i. e., the heart muscle is capable of responding to extra work. If the individual has a failing heart muscle his blood pressure, which may be at 160, will go down to zero, with perhaps absolutely no systolic pressure, on a less positive pressure than two pounds to the square inch.

The recognition of early myocardial degeneration is the next step in determining the incidence of heart disease, and the general practitioner generally overlooks these mild little murmurs which are accentuated after exercise. They may be evidences of a beginning myocardial degeneration and dilatation which mean nothing if the individual is properly treated, but unless he is warned of his condition he may do permanent damage. It is in that type of case that we should not be afraid of frightening the patient. We should tell these patients when their heart is beginning to fail and caution them to take care of it.

Dr. Roberts (closing).—Dr. Fontaine was probably correct as to the credit for the "all or none" contraction theory of the heart being due to Bowditch of Boston.

Dr. Welch called attention to the main point in question. We internists are specialists in individual medicine. The problem for us is not to be a specialist in individual curative medicine but also to learn how, practically, to catch step with our public health authorities and learn how to view and live with medicine *en masse*. This includes application of preventive medicine to large groups. Medicine is not only a science and not only an art, but it is also a function, which is but another name for public service.

While we are not perfect in diagnosis or therapeutics, we have at least a working and helpful knowledge of both. We have come to the period in which heart disease is the chief cause of death in civilization and I am very anxious to know how to prevent so much heart disease in the next generation.

Surgeons have actually taken up the question of operation on cases of mitral stenosis. We have seen one such case operated upon with apparent great benefit. Such recoveries are, of course, wonderful, but such operations are far beyond the power of any but the rare surgeon who has specialized, experimentally, upon this one operation. The problem in the child is not the rare successful operation on a mitral stenotic valve, but the prevention of the endocarditis that caused the stenosis.

Indeed our cases of organic heart diseases are already damaged when they come to us. The primary philosophy is to prevent endocarditis and organic heart disease as a whole.

Dr. Beall's remarks are very much to the point. They include for the damaged heart not only prolonged rest, but for several years he has called attention to obesity in chronic cardiacs. The chief hope is preventive medicine and the chief problem before us now is the prevention of organic heart disease.

OBSERVATIONS ON THE TREATMENT OF ACUTE CYCLIC VOMITING OF CHILDHOOD WITH GLUCOSE SOLUTION AND INSULIN*

By DAVID GREER, M.D.,
Houston, Tex.

Within the past year we have encountered two cases of acute cyclic vomiting in children of rather unusual severity to whom glucose solutions and insulin were administered with markedly beneficial results, which, we think, were probably due to the insulin.

Our reason for presenting this communication is not especially to advocate the use of insulin in the treatment of cyclic vomiting of childhood, nor to draw any definite conclusions from what may have been its effect in these two isolated cases, but simply to state certain interesting observations which were made in these two instances. It has been our experience on numerous occasions in practice in the past that liberal parenteral administration of glucose solutions has not, apparently, hastened recovery. The following observations are sufficiently suggestive to warrant reporting in the hope that more

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thorough and extensive study will be given to this phase of the disturbed metabolism which probably underlies this condition.

Case I.—A girl, H. T., five years of age, was first seen on the morning of April 21, 1924. She had suffered from ileocolitis at one year of age, varicella at two, and measles in February, 1924. Up to the time of the removal of her tonsils and adenoids in 1923, she had been repeatedly afflicted with nasopharyngeal infections and severe middle ear suppuration. Since the age of 18 months she had been a subject of frequent attacks of protracted vomiting. Her family history was unimportant.

On the afternoon of April 16 she had complained of feeling ill and at bedtime began suddenly to vomit. The temperature was normal, and there was no complaint of pain. Powders were given and a few were retained but throughout the night nothing else save a few teaspoonfuls of a solution of soda bicarbonate in water were given at frequent intervals. Practically everything was vomited. From that time to the time of the first visit on April 21, she retained nothing whatever. Even the smallest quantity of water given was rejected. Fever and pain were not present. The child had become increasingly weak and languid. One small dark green bowel movement had occurred daily.

When seen on the morning of April 21 she lay limply in a semi-stuporous state from which she was easily roused and replied feebly but intelligently to questions. Her skin was cool, moist, and somewhat inelastic, the mucous membranes bright pink, and the eyeballs markedly sunken and definitely soft. Her temperature was 99.3° F. by mouth. Respirations were thirty per minute, deep, regular, and clearly pauseless. The heart rate was 136 per minute, regular, and surprisingly strong.

The abdomen was sunken and everywhere soft and pliable.

Complete general examination revealed nothing else of direct importance.

Gastric lavage was performed, only a small quantity of dark brown mucous being recovered, after which successive dram doses of milk of magnesia were administered, following which orange juice was cautiously given. Though the child's general condition did not improve, she retained these things for four hours, whereupon all was vomited. During this time 5 per cent commercial glucose solution was given continuously by proctoclysis. At noon, and again at 7 a subcutaneous injection of 250 c.c. of 5 per cent glucose solution in physiologic saline was administered. During this first 24 hours of treatment nothing given by mouth was really retained.

On the morning of April 22 her temperature was 100.6° F. by mouth, hyperpnea was marked, and the pulse was 160. The blood showed 12,600 leukocytes, 7,200,000 erythrocytes and the differential count within the normal proportions for the age. Blood sugar by the method of Folin and Wu was 220 milligrams per 100 c.c. (0.22 per cent) and the carbon dioxide combining power by Van Slyke's method was 24 c.c. per 100 c.c. of plasma. Analysis of the catheterized urine revealed a specific gravity of 1.020, albumin ++, sugar +, acetone ++, diacetic acid +.

Any fluid or other material given by mouth was promptly vomited up to 10:30 a. m. of April 22. At 10:45 a. m., 300 c.c. of a 5 per cent solution of glucose in physiologic saline solution were given by hyperdermoclysis, and at 11 o'clock 10 units of insulin, hyperdermically. The patient slept for one and one-half hours, her color gradually improving, respirations became easier and less deep, and the pulse less rapid. She then awakened screaming, kicking and throwing herself from side to side. She was calmed with difficulty and forced to drink two ounces of undiluted orange juice. Urine voided at 6 p. m. was normal save for trace of albumin.

Throughout the remainder of the day she was comfortable and bright. All hyperpnea disappeared and she drank freely of orange juice and water. She slept quietly throughout the ensuing night and on the following day partook freely of a liquid carbohydrate diet. Her blood sugar on that day of April 23 was 130 milligram per 100 c.c. (0.13 per cent) and analysis of the catheterized urine showed only a distinct trace of albumin.

Case II.—A male child, T. C., 2 years of age, was first seen on July 26. His family and personal previous histories were negative except that at the age of eighteen months he had an illness similar to the present one, which had lasted two days and had subsided spontaneously.

For forty-eight hours preceding the first visit he had vomited continuously everything swallowed, had exhibited a temperature of 100 to 100.5° per rectum, but made no complaint except of great thirst. He appeared very prostrate and weak and manifested no desire to move. However, his color was good, he was clear mentally, and there was no abnormality of respiration or cardiac action. General physical examination was entirely negative. His leukocytes were 9,500, differential blood count normal, and the urine was normal save for a markedly positive test for acetone.

During the following forty-eight hours repeated gastric lavage, saline catharsis, orange juice and one subcutaneous injection of 300 c.c. of 3 per cent glucose solution were given without substantial improvement, the vomiting subsiding for a few hours, only to recur with unabated violence. During this time a continuous proctoclysis of 10 per cent glucose was given and retained unusually well. Urine was voided twice on July 27, and analysis of each specimen revealed marked reactions for sugar and acetone, with diacetic acid and albumin in distinct traces.

Early on the morning of July 28 the child became rapidly worse. His respirations were heaving and ceaseless, typically Kussmal in character, his pulse 160, and his mentality markedly clouded. His skin was cold, clammy, and somewhat inelastic over the anterior surface of the abdomen.

Catheterization of his bladder produced an ounce of dark amber cloudy urine which showed a heavy reaction for albumin and sugar as well as acetone and diacetic acid. He was immediately given 250 c.c. of 5 per cent glucose solution subcutaneously and 45 minutes later 10 units of insulin, hyperdermically. During the ensuing four hours he made only slight improvement, the respiratory excursions being perhaps of not such great amplitude and the extreme pallor of the skin lessening somewhat.

At the end of that time he was again catheterized and three ounces of urine were obtained which exhibited positive tests for albumin, sugar, acetone, and diacetic acid. He was then given an additional 5 units of insulin. In two hours he was remarkably improved, the hyperpnea disappeared entirely, his normal color returned and he sat up in bed and drank six ounces of orangeade and retained it. Urine voided six hours later was free of sugar and acetone bodies. His recovery was subsequently entirely uneventful.

The foregoing records were made under the stress of anxiety and circumstances urgently demanding prompt action. The observations are not the result of carefully planned or searchingly thorough work. In Case 2, study of the blood chemistry was impossible. However, is it not worthy of note that the parenteral administration of glucose solutions *alone* to these two children resulted in glycosuria in both, demonstrable hyperglycemia in one, and amelioration of the malady in neither? And that, on the administration of insulin, sugar combustion, evidently prompted, occurred with coincident subsidence of the ketosis, and thereafter apparent resumption of the normal course of carbohydrate and fat metabolism?

One question particularly comes to mind: Is there a temporary loss or decrease of sugar metabolism in cyclic vomiting? In these two cases some such condition must have obtained, to at least a degree. As far as we can ascertain, no direct investigation of this question has been made. Cyclic vomiting is in the vast majority of cases, self limited, and the mortality is exceedingly small. However, the severity of the symptoms is often great, the duration commonly three to five days with any treatment, and the resultant debilitation frequently a permanent injury to the subsequent health and constitution of the child. To consider the possibility that by giving glucose and causing its prompt metabolism through the agency of insulin we might at once limit this heretofore self-limited malady is an alluring speculation if nothing else.

DISCUSSION (Abstract)

Dr. H. Leslie Moore, Dallas, Texas.—Cyclic vomiting being a form of acidosis, the use of glucose and insulin is of undoubted value. I have given it intravenously, with splendid success. However, the general practitioner can use the method suggested by Dr. Greer, and he is the man who sees most of these cases.

Dr. J. B. Sidbury, Wilmington, N. C.—It is encouraging that most cases of cyclic vomiting, as Dr. Greer says, respond to ordinary medication. Glucose in the form of Karo syrup will effect a cure in many cases if it is given either by mouth or by rectum. Orange juice, given in small quantities, will produce the same effect. But there are cases that do not respond, in which 10 per cent glucose intravenously will effect a cure. Glucose given intravenously furnishes the combining power that restores the balance and readjusts metabolism. We are interested to find that insulin given intravenously will produce results in difficult cases.

Dr. Robert A. Strong, Hagerstown, Md.—If we do not want to discredit insulin we should make sure that it is carefully buffered with glucose in these conditions.

Dr. Greer (closing).—In these two children there appeared to be very little sugar combustion until the insulin was given. I wonder if there may be a decrease of sugar metabolism in cyclic vomiting.

ROENTGEN ANALYSIS OF SOME UNUSUAL ABDOMINAL LESIONS*

By E. H. Skinner, M.D.,
and
Ira H. Lockwood, M.D.,
Kansas City, Mo.

CASE OF CALCIFIED KIDNEY AND URETER

The rarity of case reports on calcification of the kidney and ureter leads us to report this case. In reviewing the literature on this subject one finds very little regarding the etiological factor. Wells, in his article on calcification and ossification, says that we find calcium deposits occurring in perfectly normal tissues, especially in the lungs, stomach, and kidneys, and he lays stress on the fact that in these organs we have three chief places where acids are found. In the lungs we have carbon dioxide which passes on into the blood as carbonates. In the stomach hydrochloric acid is secreted and in the kidneys, acid phosphates.

Wells believes that the coincidence of the location of the calcium deposits and the acid secreting function of the tissues leave little or no room for doubt that the precipitation of calcium occurs in the condition known as metastatic calcification because calcium salts are slightly less soluble in the more alkalin fluids than are present in these tissues. That calcification of the renal epithelium does occur has been proven experimentally by ligation of the renal vessels and by administration of certain poisons. However, it is believed that the calcification is preceded by hyaline changes and that the calcium is later deposited.

The maintenance of a healthy kidney depends almost entirely upon the amount of work thrown upon it, plus the maintenance of free drainage. The first factor is in direct relation to the general physical condition of the patient, and the latter to free exit from the kidney tubules to the bladder and sometimes from the bladder. The effect of ureteral occlusion upon the kidney and ureter is most striking. Usually the effect upon both is a gradual dilatation, but sometimes we see an atrophy of one or both taking place. Barney has shown by his experiments that the question of dilatation or atrophy, when the ureter is suddenly or completely obstructed, depends upon the accessory venous

*Read in Section on Radiology, Southern Medical Association, Eighteenth Annual Meeting, New Orleans, La., Nov. 24-27, 1924.

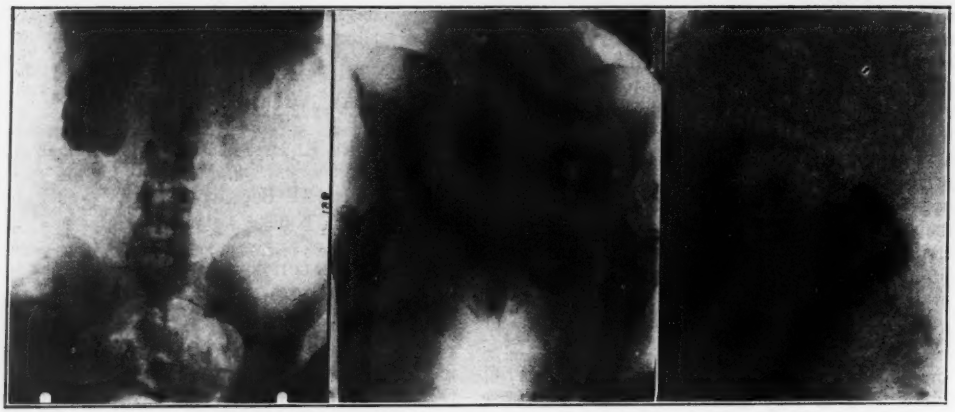

Fig. 1. Fig. 2. Fig. 3.

Fig. 1.—Calcification of the right kidney and the lower portion of the ureter.
Fig. 2.—Dermoid cyst with several well-formed teeth anterior to the sacrum.
Fig. 3.—Leaking duodenal ulcer with the opaque substance entirely outside the confines of the gastro-intestinal tract.

anastomoses through the renal capsule, the spermatic, infra-diaphragmatic, uterine, suprarenal, and the subcutaneous plexus of the lumbar region, together with other veins of that area.

When the obstruction of the ureter occurs suddenly, there is a marked distention of the venous plexus with a pronounced increase of intrarenal tension. The parenchyma of the kidney shows an intense hyperemia and edema and since it cannot expand within its capsule, the intrarenal pressure becomes so elevated that the venous capillaries of the parenchyma become obliterated. If the compensatory venous circulation through the capsule is sufficient then we have a balanced circulation and continuance of urinary secretion with a hydronephrosis developing. If, however, this accessory circulation is not sustained, then the intrarenal pressure becomes so great that it produces not only venous but arterial capillary obstruction and secretion ceases. There is resultant atrophy with a tendency toward calcification if there be any infectious process within the kidney or any focal infection in the body.

E. B. N., a woman of 40, gave a negative family history. She had been married 18 years, and had three strong, healthy children, with no history of miscarriage.

She entered the hospital complaining of severe constant headache and pain in the lumbar region radiating around the left side to the mid-line with a corresponding pain on the right side which did not radiate. She was very constipated, belched a great deal of gas, with frequent nausea and vomiting. She also complained of pain in the urinary bladder.

The pain in the lumbar region began about six years before, following an operation for removal of the appendix and fallopian tubes.

Physical examination was negative, except that the abdomen showed an old operative scar in the lower right quadrant. The abdomen was flat and there was a palpable mass under the right costal margin which was rather hard and fixed.

X-ray plates of the genito-urinary tract showed the left kidney to be of normal size, shape and position and no evidence of calculi in the left kidney, ureter or the urinary bladder. There was a large calcified area corresponding to the size, shape and position of the right kidney with calcification corresponding to the course of the ureter, the calcification being more dense in the lower third.

Cystoscopic examination and urethral catheterization were done and the urinary bladder was found to be normal throughout. The left ureter was easily found and a catheter readily passed up 10 centimeters when it met an obstruction that was passed with difficulty. On the right side of the bladder a depression was seen which was apparently the obliterated opening of the ureter. No catheter or bougie, however fine, could be inserted.

The findings from the cystoscopic examination were: there was only one functioning kidney, the left; the right ureter having, in all probability, been severed at an operation about eight years previously. The right ureter and kidney had so calcified as to cast a shadow on the x-ray plate. There was only one ureter in the trigone, the right having become obliterated. The urinary bladder capacity and mucosa were normal.

To prove that there was only one functioning kidney the left ureter was plugged with a No. 9 Garceau catheter and the urinary bladder emptied with a soft rubber catheter which was left in place to drain, in case any urine should come from the right side. No urine or dye whatsoever was obtained.

Stereoscopic negatives after an injection of an opaque medium into the left kidney pelvis and ureter showed a

slightly deformed pelvis and marked kinking of the ureter.

Conclusions from the cystoscopic and x-ray examinations were that the patient had only one functioning kidney, the left, which showed diminished function according to the creatin test, with evidence of pyelitis. There was a definite kink in the left ureter which might cause future disturbance. It was felt that operation was contra-indicated on the calcified kidney, because of the condition of the other kidney and that, at the present time, it was causing no untoward symptoms.

REPORT OF A CASE OF DERMOID CYST OF THE LEFT OVARY

A. A. L., age 23, was referred to the x-ray department for examination of the pelvis and abdomen by Dr. Lee Miller. When he saw the patient she complained of an excruciating pain in the left lower abdomen, which had a very sudden and severe onset. She had had no previous attack and had always been well and strong. Menstruation had started at 15 years of age and had been normal in every respect.

Physical examination revealed an apparent mass in the lower left pelvic region.

X-ray Findings.—Fluoroscopic examination showed a well-defined area of increased density in the lower left pelvic region that, upon manipulation, was found to be freely movable. Negatives of the pelvic region showed, just anterior to the promontory of the sacrum, several well-defined bodies that had the density of dentine and the anatomical appearance of teeth. A diagnosis of dermoid cyst of the left ovary was made.

Operative Findings.—A median line incision was made and a large cyst with a long pedicle was found. The pedicle had become so twisted that the circulation was shut off from the cyst. The walls of the cyst were very dark and showed evidence of gangrenous development.

The cyst was removed and contained hair, a soft gelatinous substance and teeth, of the temporary type, but perfectly formed and some with root canals. The patient made an uneventful recovery.

CASE OF LEAKING DUODENAL ULCER

J. L. B., age 42, was of the neurotic type, inclined to worry a great deal, especially about business affairs, and had complained of stomach trouble over a period of a number of years, with abdominal distress, soreness, and tenderness over the region of the pylorus.

On July 24, 1923, he ate a heavy meal of green corn and sausage. About 30 minutes afterwards he was seized with a sudden severe attack of pain in the abdomen, became nauseated and vomited several times. Following this there was a sudden cessation of pain with a rise in temperature, and the patient complained of exhaustion.

On August 1, 1923, the patient entered St. Luke's Hospital and was referred to the x-ray department for examination.

X-ray Findings.—Examination of the gastro-intestinal tract showed a stomach of normal size, shape and position with active peristalsis, the waves being increased both in frequency and depth. There was no evidence of intrinsic or extrinsic involvement of the walls of the stomach.

There was a constant deformity of the cap of the duodenum, clover-leaf in type, with an area of increased density above the pyloric end of the stomach and to the right of the vertebral column. While observing this patient under the fluoroscope there was a small opaque mass that suddenly passed from the cap of the duodenum outward to this dense area. It had the consistency and density of the barium meal and apparently passed beyond the confines of the gastro-intestinal tract. The findings of the fluoroscopic examination were indicative of a leaking duodenal ulcer. Negatives made of this region show a small opaque mass outside the limits of any portion of the gastro-intestinal tract.

The stomach was very active and was entirely emptied at the end of two hours. At the end of twenty-four hours the colon was well outlined and quite normal in appearance. Our conclusions in this case were that we were dealing with a duodenal ulcer that had a slow leak into the lesser peritoneal cavity.

Operative Findings.—On August 10, 1923, the patient was operated upon and a mass found in the sub-hepatic fossa which contained pus and debris. The cavity was drained and the patient made an uneventful recovery. Three weeks later a second x-ray examination was made and the same deformity of the cap of the duodenum persisted but we were unable to make out any mass in the sub-hepatic fossa as in the previous examination.

SARCOMA OF THE KIDNEY IN A CHILD

B. T., 6 years old, had a negative family history. She entered the hospital complaining of pain and a mass in the left kidney region. The pain was of the pressure type and did not seem to radiate. The child had been perfectly well until two months before when she had a fall and bruised the left side. Since that time she had complained of some pain, had had a slight rise in temperature, and the mass had apparently grown very rapidly.

Blood count showed a leucocytosis of 11,000, with red cells and hemoglobin normal. The urine contained a few pus cells, but no blood, casts or albumin. It was acid in reaction and of normal specific gravity.

Physical Examination.—There was a mass in the hypochrondrium as large as a good sized grapefruit, that extended around the left side to the kidney region, up under the left costal margin and past the mid-line in front. Its consistency was firm. Apparently there was no tenderness or pain on pressure and the mass was not movable.

Examination of x-rays of the genito-urinary tract showed the right kidney to be normal in position, size, and shape. In the left kidney region there was a dense mass, with its lower border in the pelvic cavity, which pushed the stomach upward and to the right. It also pushed the diaphragm upward and the lower ribs outward. We were unable to make out a definite outline of the left kidney.

Operative Findings.—The right kidney was normal and there was a large retroperitoneal mass about four by six inches in size. It involved the entire left kidney and the colon was attached to this mass. The child was apparently in good condition when she left the operating room, but about ten minutes later there was a sudden collapse and she died almost instantly.

The probable cause of death was felt to be embolus from the tumor mass.

The microscopical findings were those of sarcoma.

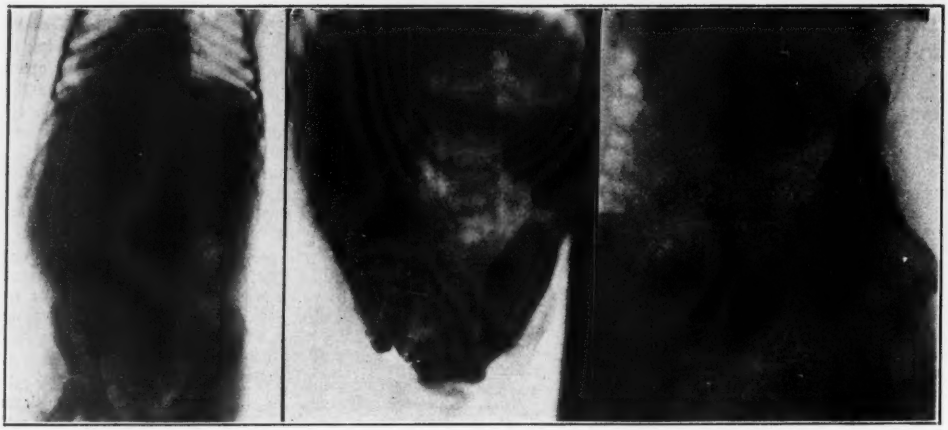

Fig. 4. Fig. 5. Fig. 6.

Fig. 4.—Sarcoma of the kidney, proven at operation.
Fig. 5.—Enterolith in the sigmoid.
Fig. 6.—Filling defect of the cecum, probably malignant, proven by microscopic examination.

ENTEROLITH

True intestinal stones in early life are rare. We are unable to find any reported case in a child under six years of age. The case described occurred in a breast-fed infant eight months old.

W. J., 8 months old, had been fairly well nourished on the breast with a monthly gain of one pound. He had never had an unassisted bowel movement. Meconium was evacuated for the first two weeks by rectal irrigation and fecal matter was not seen in the stools until after the infant was two weeks old, when hard fecal masses were obtained by irrigation.

When castor oil was given the stools became liquid and on one occasion blood was found. During the eight months of obstinate constipation numerous laxatives, including croton oil, were tried by the attending physician and they were often unsuccessful for several days at a time.

At eight months of age, the infant developed a rise of temperature of two degrees and the appetite failed, but he took quantities of water, very eagerly. Vomiting occurred twice daily for two days and on the third day of illness he was taken to St. Luke's Hospital for observation.

Examination.—He was a well nourished infant, weighing 17 pounds, with an anxious expression of the face and the eyes sunken. The temperature was 102°. The abdomen was distended so that palpation was difficult.

Unfortunately no roentgenograms were made before the barium was given. Examination of the colon by means of a barium enema revealed the fact that the rectum filled readily and the opaque medium passed up into the sigmoid, but we were unable by pressure, manipulation, or change of position to force it beyond this point in the sigmoid.

Examination by the ingested meal showed a normal stomach and the opaque meal passed readily through the small intestine. At the end of twenty-four hours the meal had reached and filled the cecum and at the end of forty-eight hours the entire colon was outlined as far as the middle portion of the sigmoid, where a portion of the opaque medium had apparently surrounded a less opaque area about one and one-half inches in diameter. This less opaque medium was somewhat movable, rounded and smooth in outline, and our conclusions were that it was an enterolith acting as a ball-valve in the sigmoid.

There was considerable barium still present in the colon 120 hours after the meal.

The infant was given an anesthetic, the colon was irrigated and a large quantity of fecal matter was obtained. Examination of the abdomen while under the anesthetic revealed a hard globular mass.

Laboratory Findings.—Leucocytes, 23,200; polymorphonuclear leukocytes, 47; large lymphocytes, 5; small lymphocytes, 47; and transitionals, 1 per cent.

The urine showed a trace of bile and an occasional pus cell.

Operative Findings.—A median line incision was made, the sigmoid was picked up and a mass was felt within it, that would slip up and down. An incision of the sigmoid was made and the mass delivered, which was hard and firm and measured three and one-half by five centimeters.

Two months later the infant had gained two and one-half pounds and had had several well formed stools, although some cathartics and the use of suppositories had been necessary.

CARCINOMA OF THE CECUM

This case is of a woman of 24, whose mother died of carcinoma of the stomach. Other family history was negative.

In June, 1923, she complained of very severe pain in the abdomen that came on in paroxysms, and was relieved for an hour after eating and also by soda. Since June, the bowels had been loose and watery with

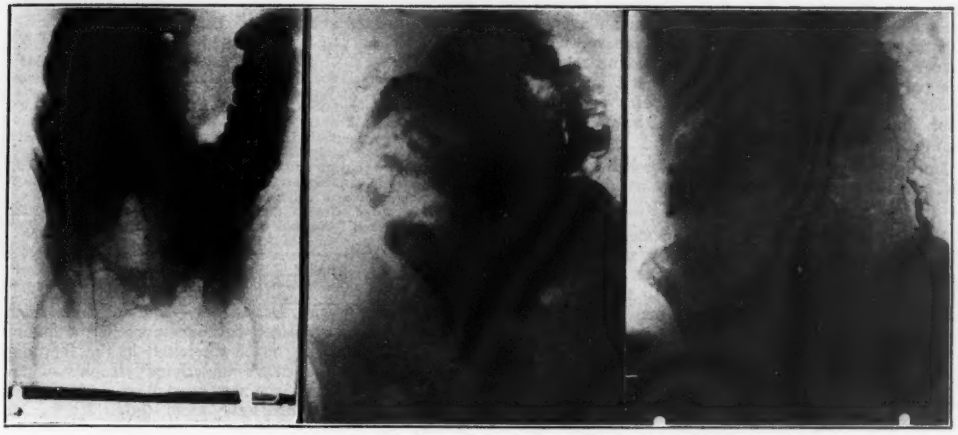

Fig. 7. Fig. 8. Fig. 9.

Fig. 7.—Colonic retention for forty-one days.
Fig. 8.—Large appendiceal abscess pushing small intestines to the right.
Fig. 9.—Appendiceal abscess with undescended and unrotated cecum.

four or five movements a day. The patient had lost twenty-five pounds in four months.

Physical examination was negative except in the abdomen, which was tender in the right lower quadrant. There was a palpable mass in this region about the size of a small lemon. It was firm, slightly movable, and tender on deep palpation.

On October 7, 1923, the patient was referred to the x-ray department of St. Luke's Hospital for examination of the gastro-intestinal tract. The stomach was found to be of the typical water-trap type and showed a marked increase in peristaltic action. There was no evidence of pathological change in the cap of the duodenum.

At the six-hour interval the head of the meal had reached the splenic flexure and there was a constant filling defect that apparently involved the lumen of the cecum. The appendix was demonstrated showing several filling defects. The filling defect of the cecum remained constant over a period of forty-eight hours.

The conclusions of the x-ray examination were that there was chronic appendiceal pathology and an irregular and constant filling defect of the cecum, that we felt was malignant.

Operation.—The abdomen was opened, the cecum was delivered and a rather hard mass was found. A resection of the cecum was made and an anastomosis of the terminal ileum to the ascending colon was performed.

Microscopic examination of the growth proved it to be adenocarcinoma.

The patient made an uneventful recovery, in one year has gained forty pounds and is apparently well and strong.

COLONIC RETENTION FOR FORTY-ONE DAYS: SIGMOIDAL CANCER

Mr. J. A. P., age 43, gave a negative family history. He complained of pain and loss of weight.

In the preceding few months he had had abdominal pains and partial stoppage of the bowels. The pain had been all over the abdomen, never localizing in one area, occurring every few minutes, especially after a meal. The pain was relieved by passage of gas from the bowels and no particular kind of food seemed to have any bearing upon the pain and discomfort. There has been very little belching of gas, and no nausea or vomiting. The patient had been very constipated, frequently used a cathartic, and had lost about 15 pounds during the preceding year, which he attributed to the stomach trouble which had extended over this time.

He was given a barium meal for gastro-intestinal examination September 5, 1923, in the office of a colleague. On September 23, 1923, it was found that the barium had not passed from the colon and the patient was given repeated enemas.

On September 27, 1923, the patient was referred to the x-ray department of St. Luke's Hospital, 22 days after the barium was given. We found the colon still outlined by the opaque medium. There was marked dilatation of the colon. The haustral markings were very definitely defined and there was an abrupt ending of the shadow in the sigmoid.

He was observed frequently until October 16, 1923, 41 days after the barium meal, and the same findings were noted as in the first examination.

Operation.—An exploratory incision was made and a large mass involving the middle part of the sigmoid was found. A colostomy was done, a section removed and microscopical examination proved it to be adenocarcinoma.

LARGE APPENDICEAL ABSCESS

B. N., a woman of 34, gave a negative family history.

About two months previously, after a severe infection of the left thumb, she was seized with cramps in the abdomen, which lasted about five minutes and occurred four or five times a day. Whenever she had a bowel

movement the cramps were more severe and during the preceding three weeks, she had had on an average of five bowel movements a day, thin, watery, with no mucus or blood. Food, apparently, had no relation to the pain. She was somewhat nauseated and vomited about once a day with no relief. Her appetite was poor, and she lost 23 pounds within the preceding two months.

During the preceding two weeks she had been coughing, perspired a great deal, especially at night, and her temperature was 102-103°.

Physical Examination.—The abdomen was tender, distended, and there were no palpable masses. Vaginal examination revealed an indistinct mass not easily outlined that was soft and boggy and to the right of the median line. Clinical diagnosis was malignant papilloma of the right ovary with metastases.

X-ray Examination.—The stomach and duodenum were negative. At the six-hour interval the opaque medium was in the small intestines, which were held well to the left of the median line. Apparently a mass was holding or rather pushing them to the left. None of the opaque medium had entered the cecum. The small intestines were distended and showed a loss of their characteristic appearance. There was no evidence of any involvement of the lumen of the bowel. Consequently we felt that there was a mass in the lower right quadrant pushing the small intestines to the left of the median line.

Operation.—Incision and drainage of a large abdominal abscess in the lower right quadrant.

LARGE APPENDICEAL ABSCESS WITH INCOMPLETE ROTATION OF THE CECUM

G. A. L., a man of 56, gave a negative family history. He complained of pain in the right upper quadrant that began three weeks before. During the first week this pain was continuous. He was never free from it, and at times it was almost unbearable. During the second week the pain became paroxysmal but more general over the abdomen. The patient was jaundiced, stools were normal in color, but with very offensive odor, and his temperature throughout the week was 101-102°. During the third week the pain became more severe, and the temperature remained 101-102°.

Physical examination showed the abdomen slightly distended, some rigidity over the right side and tenderness over the gall bladder and appendix.

X-ray Findings.—The stomach and duodenum were negative. At the six-hour interval the opaque medium had reached and filled the cecum which was held high up under the liver with evidence of a filling defect that was apparently extrinsic, and inflammatory in character. The small intestines showed a rather marked filling that seemed to be due more to stasis than to obstruction. At the twenty-four-hour interval the cecum remained filled, with the same evidence of a filling defect.

A barium enema showed marked spastic areas at the junction of the pelvic and descending colons. The colon filled readily and the same findings were observed in the cecum. From the base of the cecum there was a barium shadow that went upward and filled a pouch-like affair that was apparently entirely separated from the colon.

Operation.—Incision and drainage of a large appendiceal abscess. The cecum was found up under the liver and fixed in this position. Apparently it had never entirely rotated and descended.

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DISCUSSION (Abstract)

Dr. Davis Spangler, Dallas, Tex.—The one thing about true dermoid cyst which is pathognomonic is the finding of teeth. I was very much interested in the thorough presentation of the causes underlying atrophy of the kidney. To me this is a new conception and explanation of this entity and deserves close study. I am going to take the liberty of presenting two lantern slides of kidney conditions which have been extremely interesting to me.

The first case is one of markedly dilated ureter with virtually a normal kidney pelvis, infundibulum and calices. I have never before seen one of these marked dilatations of the ureter which had not more change in the kidney substance. The second case is that of a young negro boy, 14 years of age who had a bilateral hypernephroma. I am not sure whether the pathologic diagnosis was sarcoma or hypernephroma.

Dr. Charles Waters, Baltimore, Md.—Dr. Lockwood failed to state the nature of the first kidney case. We have had quite a few of those in Baltimore and all of them were tuberculous. Dr. Braasch of the Mayo Clinic has given the name of autonephrectomy to this condition, because the tuberculous process has automatically undergone calcification, the end stage of tuberculosis. The ureter is often involved in the same process.

Dr. Lockwood (closing).—In answer to Dr. Waters' question we were unable to obtain the tubercle bacilli or anything that made us think, from our examination, that this was tuberculosis. Undoubtedly it is, as the majority of these cases, with a calcification of the extent of this, are tuberculous in origin.

A CONSIDERATION OF CREEPING ERUPTION IN THE SOUTHERN STATES WITH AN ENTOMOLOGICAL REPORT*

By J. L. KIRBY-SMITH, M.D.,
Jacksonville, Fla.

The idea in view when making this report on creeping eruption was to bring forward certain facts in regard to the prevalence of this very

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TABLE No. 1
SHOWING GEOGRAPHIC DISTRIBUTION OF THE DAMP SAND TYPE OF CREEPING ERUPTION IN THE UNITED STATES, 1924

Location of Origin	Cases Reported by	No. of Cases	Years	Remarks
Mobile, Alabama	Dr. T. Gaines	4 to 5	Yearly	From Creekbanks
Selma, Alabama	Dr. Lee Jones	Frequent	1922-23	
Arcadia, Florida	Dr. M. L. Crum	4	1923-24	
Cocoa, Florida	Dr. W. L. Hughlett	Frequent	Yearly	
Daytona Beach, Florida	Dr. Jack W. Jones	3	1923	Non-resident
Eustis, Florida	Dr. Chas. H. Sidor	Frequent	1924	
Homestead, Florida	Drs. Jordan and Smith	12	Yearly	
Jacksonville, Florida	Members of Profession	Frequent	Yearly	
Jacksonville, Florida	Dr. J. L. Kirby-Smith	2000	14 years	Fla. localities
Live Oak, Florida	Dr. J. M. Price	Frequent	1924	
Ocala, Florida	Dr. Henry C. Dozier	Frequent	Since 1905	See Bibl.
Orlando, Florida	Dr. G. H. Edwards	Frequent	Since 1915	See Bibl.
Miami, Florida	Dr. Elmo D. French	1	1924	Multiple lesions
Pablo Beach, Florida	Dr. J. L. Kirby-Smith	Frequent	Yearly	
Pensacola, Florida	Dr. J. H. Fellows	6	Yearly	
Pensacola, Florida	Dr. J. H. Pierpont	Few	Yearly	
Perry, Florida	Dr. J. C. Ellis	Frequent	Yearly	
Quincy, Florida	Dr. Wm. W. Massey	1	1924	
Sarasota, Florida	Dr. Joseph Halton	Frequent	Yearly	
St. Augustine, Florida	Dr. J. L. Kirby-Smith	2	1924	
Tallahassee, Florida	Dr. F. Clifton Moor	Frequent	1924	
Tampa, Florida	Dr. R. A. Ely	Frequent	1924	
Tampa, Florida	Dr. J. J. Saxton	Frequent	1924	
Tampa, Florida	Dr. C. A. Andrews	Frequent	1924	
W. Palm Beach, Florida	Dr. H. L. Gunter	12	Yearly	
W. Palm Beach, Florida	Dr. O. F. Schiffli	Few	Yearly	
Winter Park, Florida	Dr. J. F. Gardner	Frequent	Yearly	
Savannah, Georgia	Dr. S. E. Bray	Frequent		
Baltimore, Maryland	Drs. J. W. Lord and I. R. Pels	Few	Yearly	Origin nearby
Stone Harbor, N. J.	Dr. Lloyd W. Ketron	1	1920	From beach
Wildwood, N. J.	Dr. J. J. Klauder and Dr. S. S. Greenbaum	2	1920	From beach
Oklahoma City, Okla.	Dr. Everett S. Lain	3	Yearly	See Bibl.
Sumter, South Carolina	Dr. H. A. Mood	4	1923	Extremities infested
Dallas, Texas	Dr. J. B. Shelmire	50 since	1905	See Bibl.
Galveston, Texas	Dr. E. D. Crutchfield	15	2 years	See Bibl.
McAllen, Texas	Dr. Chas. Perry Gray	About 100	1917	Army Ser. See Bibl.
San Antonio, Texas	Dr. I. L. McGlasson	About 100	Total	Prevalent West

interesting and little known parasitic skin disease, in the coastal regions of the South Atlantic States, especially the peninsula of Florida, from the spring until the fall during the rainy season of that period, also to give a brief history of the recent creeping eruption clinic held in Jacksonville.

During fourteen years' practice of dermatology, in Florida, the writer has had the opportunity of seeing not less than two thousand five hundred cases of creeping eruption in a private and dispensary practice. These figures are conservative, and are not exaggerated. A record of three hundred cases this past summer with climatic conditions unfavorable for the occurrence of the affection, will bear out the preceding assertion of the huge number of creeping eruption cases in Florida.

For several years the matter of obtaining the assistance of entomologists in the study of the etiology of creeping eruption has been of the foremost importance in the writer's mind. Finally the personal interest of Mr. F. C. Bishopp, Entomologist of the United States Bureau of Entomology, was enlisted. This gentleman, though not having had the opportunity of a first-hand study of creeping eruption, had made a special study of it from all the available literature on the subject. A two-years' correspondence with Mr. Bishopp resulted in his active participation in the work of a first-hand study of the parasitology of creeping eruption with his associate, Mr. W. E. Dove, also of the United States Bureau. Plans were made to hold a creeping eruption clinic in Jacksonville. With the cooperation of the State Board of Health and the Jacksonville City Board of Health and the local medical profession, a clinic was opened at the executive office of the State Board of Health, July 20. During the ten days' clinic three hundred and forty-three patients presented themselves for treatment. Of this number one hundred and fifty-eight patients had common parasitic affections, mostly trichophytosis and some impetigo. At the last moment, Mr. F. C. Bishopp, one of the entomologists, was unable to attend the opening of the clinic, but with Mr. W. E. Dove present we began our work. The clinic had two definite purposes in view: first, a simple, efficient and painless treatment of creeping eruption; second, the recovery and identification of the causative parasite.

At the beginning of the clinic we made a list of a number of measures that had been used by the medical profession for the cure of creeping eruption, and in addition to this list we intended to try several other measures. The injection of various chemicals, using a small caliber hypodermic needle, into and beyond the creeping fur-

TABLE No. 2
GEOGRAPHIC DISTRIBUTION, CERTAIN LOCALITIES OF THE UNITED STATES INDICATING THE EXTENT OF THE DAMP SAND TYPE OF CREEPING ERUPTION, 1924

Locality Report	Status Reported by	No. of Cases	Remarks
Birmingham, Alabama	Dr. Andrew L. Glaze	1	Origin Florida
Hot Springs, Arkansas	Dr. Lloyd Thompson	none	
Washington, D. C.	Dr. H. H. Hazen	2	Origin Florida
Washington, D. C.	Dr. Randolph B. Carmichael	none	
Washington, D. C.	Dr. C. A. Simpson	3	Two originated that vicinity
Atlanta, Georgia	Dr. Jack W. Jones	3	Origin Florida
Atlanta, Georgia	Dr. Cosby Swanson	number	Origin elsewhere
Macon, Georgia	Dr. J. M. Sigman	12	Yearly Middle and South Georgia
Louisville, Kentucky	Dr. W. J. Young	none	
New Orleans, Louisiana	Dr. H. E. Menage	none	
New Orleans, Louisiana	*Dr. Isadore Dyer	none	
Charlotte, North Carolina	Dr. J. A. Elliott	3	Origin Georgia and Florida
Raleigh, North Carolina	Dr. C. O. Abernathy	none	
Chattanooga, Tennessee	Dr. S. S. Marchbanks	none	
Jackson, Tennessee	Dr. B. C. Arnold	none	
Memphis, Tennessee	Dr. Marcus Haase	2	Origin elsewhere
Nashville, Tennessee	Dr. J. M. King	1	Origin Florida
Sewanee, Tennessee	Dr. R. M. Kirby-Smith	none	
Richmond, Virginia	Dr. E. P. McGavock	none	
Richmond, Virginia	Dr. Thomas W. Murrell	1	Imported

*Information obtained prior to 1920.

row in the skin, was tried in thirty patients. Among the list of chemicals used were:

Two per cent mercurochrome, 10 per cent phenol, chloroform, saturated solution hyposulphite of soda, tincture of iodin, benzol, and cacodylate of soda.

All of these were found to be of no value in the cases treated. In fact, some were both doubtful and painful measures. In the case of benzol injections, gangrenous sloughs resulted. Generally speaking, injections of any nature are not a practical measure in the treatment of creeping eruption. The vast majority of patients are children and the locations of the lesions are usually the extremities, especially fingers and toes, and one readily understands the difficulty of giving a hypodermic treatment under such conditions.

On general surfaces of the skin, many cures were produced by curettement or incision of furrows, followed by applications of the following chemicals: phenol, tincture of iodin, 2 per cent mercurochrome, 50 per cent nitrate of silver solution, 1 to 500 bichlorid of mercury solution. We used 6 per cent salicylic acid in flexible collodion, but with negative results.

Refrigeration with ethyl chlorid and solidified carbon dioxid gave positive results in 20 per cent of cases treated by these measures, with active lesions located on the arms, legs, and trunk. Owing to the intensity of the freezing with carbon dioxid it is painful and productive of slow-healing sloughs. Generally speaking, the treatment of creeping eruption was approached with a knowledge of the difficulties of obtaining a uniform and painless treatment.

Discussing the matter with Mr. Dove, the entomologist, we arrived at the conclusion that the treatment of creeping eruption must be worked out on a simple basis. One point we especially emphasized, that the larvae producing creeping eruption unquestionably require air. To prove this we made use of ordinary breast pumps on lesions on the upper extremities and where a vacuum could be obtained, keeping the vacuum cup in place for an hour or more, we were able in several instances to stop permanently the creeping lesion.

Mr. Bishopp, who was in Washington at the time, had sent us a quantity of ethyl acetate with the suggestion that we give this chemical a thorough trial. On obtaining the ethyl acetate we decided to discard other measures of treatment and use this measure thoroughly. The Bureau of Entomology had tested ethyl acetate and had found it to be an active parasitic destroyer. The chemical has a very penetrating power and is not toxic or irritating to the skin. We discovered that the topical applications of ethyl acetate in a number of cases of creeping eruption caused the disappearance of the lesion in twenty-four hours. The chemical was applied using cotton batting with a rubber tissue envelope to prevent evaporation. At a later time we substituted the ordinary sulphuric ether in collodion, with ethyl acetate, using this as a topical application, having the patient apply with a brush two or three times a day, plentifully and well beyond all visible signs of the affection. In a number of cases we used in this collodion mixture 6 per cent salicylic acid, but in checking up our data later the results from this treatment showed no beneficial effects from the salicylic acid used, and the collodion and ethyl acetate alone produced prompt results and with less irritation to the skin.

Map of distribution creeping eruption as obtained from questionnaires.

In consideration of ethyl acetate as an effective means of curing creeping eruption, attention is called to a patient with several hundred active lesions on the trunk and upper extremities, the infestation being of thirty-six hours duration. Some of the lesions showed beginning migrations, but most of them were in a state somewhat like the eruption of papular urticaria. This individual suffered tortures from the itching and was unable to sleep or to attend to any of his duties. One well applied application of ethyl acetate, a a pound of chemical being used, for wetting the cotton pads which were applied directly to the affected parts, caused the disappearance of most of the lesions treated within twenty-four hours. As a rule, individuals having creeping eruption do not resort to medical treatment until their affection has existed for quite a while, usually trying home remedies and the various patent medicines that are on the market for the relief of "ground itch." As constant itching is a symptom of the disease, naturally severe infection of the skin results from the frequent scratching of the sufferer.

Up to the present moment no definite announcement is to be made as to the recovery or identification of a parasite that causes creeping eruption. Though it appears to be a simple procedure, the recovery of a parasite is exceedingly difficult. Judging from the signs of the creeping lesions it would appear that we are dealing with a larval parasite of sufficient size to be readily picked out from the creeping furrow. Such, however, is not the case. This parasite is undoubtedly quite a distance from all the visible inflammatory lesions in the skin produced by its migrating, and no doubt is microscopic in size. The creeping eruption of the skin is nothing more than an inflammatory furrow in the skin which this larval parasite has made.

From the very beginning of the clinic we were struck with the difficulty of obtaining skin sections for laboratory study. Most of these active lesions appear on the fingers and toes of the patient, and naturally these locations are not suitable for biopsy. Nevertheless, we obtained, through the assistance of local surgeons thirty specimens for study from the trunks and upper extremities of the infected patients. The scrapings from ends of furrows have been obtained from at least one hundred and fifty patients. A number of the specimens were placed in blood serum, some in alcohol and a few were examined here, but the majority of the specimens were sent to the Bureau of Entomology in Washington, for detailed study. In due time, possibly within the next few months, the parasite will have been recovered and identified.

This report is necessarily a brief one, our work being just begun on this extensive and intensive study of the disease. The subject of creeping eruption is certainly a problem of magnitude, not only in Florida, but in other sections of our country.

Mr. Dove, the entomologist who has been associated with me for the past year, will, in his report, cover the different phases of the investigation that we carried out last summer.

It is hoped that the photographs shown you today will furnish an adequate idea of the immensity of the creeping eruption problem as it exists in Florida. The geographic distribution, as obtained from the questionnaires that I have sent out, will no doubt be of interest to all of you.

To summarize, the following facts are brought forth: creeping eruption is a common skin affection in the rainy season in the Southeastern states. Treatment in the past has been painful and unsatisfactory. Ethyl acetate is suggested for a thorough trial, as it has proven efficient and non-irritating. Though much work has been executed during the past summer, the etiology of creeping eruption remains unsolved.

No. 1.—Creeping eruption lesion three weeks duration.

ENTOMOLOGICAL REPORT

By W. E. Dove,
U. S. Bureau of Entomology

In 1910 Miller[22] reported a case of creeping eruption in which the parasite was determined by Dr. C. W. Stiles as a second stage larva of hypoderma lineatum. In 1889, Kane[14] reported a case whose parasite was determined as hypoderma bovis. This established proof that both species of cattle grubs occurring in the United States are occasionally causative of creeping eruption in man. The habit of burrowing into the normal skin coincides with that of their method of ingress into cattle.[1]

The similarity of the newly hatched larvae of hypoderma to those of the gastrophilus probably accounts for the fact that many cases of "creeping eruption" have been reported in which the cause was thought to have been due to gastrophilus. Fantham, Stephens, and Theobald[6] say that Cholodowsky attributed the "wormlet" observed by Samson[26] and Sokolow[33], (1895 and 1897) to gastrophilus larvae. Roubaud[25] has shown that newly hatched gastrophilus larvae when placed on the buccal mucosa, promptly burrow into the tissue and lie parallel to the surface in a comparatively shallow position. He thinks that bot larvae in the human skin enter through the lips or eyelids or through an abrasion in the skin.

In 1923, Dr. Alfred Schalek[27] reported a case of creeping euption from Nebraska, and the larva recovered has been obtained from Dr. E. T. Manning. Confirming his belief it was found to be a first-stage larva of gastrophilus hemorrhoidalis and the determination of the species was verified by Mr. E. W. Laake and Mr. F. C. Bishopp. It is probable that in the case reported by Dr. Schalek a newly hatched larva came in contact with a lesion on the patient's arm. Gastrophilus are not known[3] to burrow into the skin in the normal method of ingress into the stomach and duodenum. They hatch from moisture and friction of the horses' lips and they are swallowed with the food, and it is quite likely that cases of creeping eruption caused by gastrophilus are of rare occurrence.

In 1920 and 1922, Dr. E. M. Walker,[39] [40] working with material from Toronto, Canada, described cases of cutaneous myiasis, from which larvae were extracted from boil-like sores. These larvae had entered the healthy skin of an infant, and when removed were reared on raw beef, under laboratory conditions. The species of fly was named *wohlfahrtia vigil* and is closely related to the species occurring in Russia, *wohlfahrtia magnifica,* whose larvae are frequently deposited in the natural orifices of man or animals. Dr. Walker's type of human myiasis is not a creeping type. *Wohlfahrtia vigil* has been recorded by Shannon, 1923,[28] from young rabbits and a young pup, in which the maggots had worked their way deep into the flesh. They left the host about four days after they appeared.

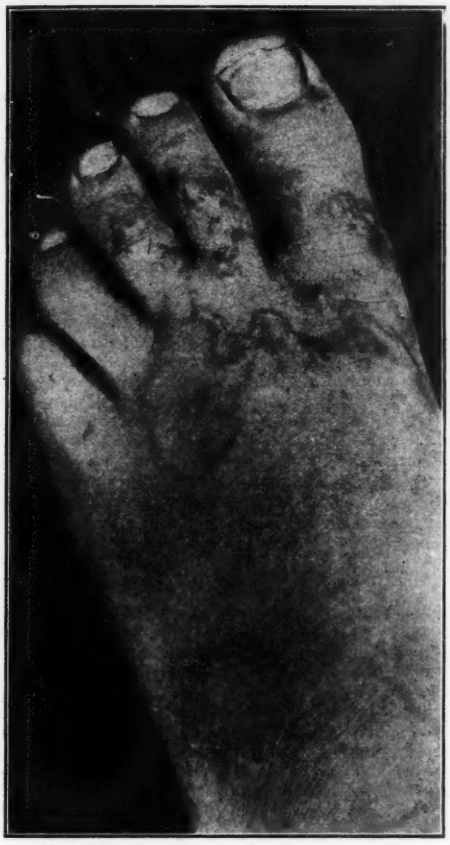
In all of the cases above mentioned in which parasites were recovered, the larvae were of sufficient size to be observed with the naked eye and without serious difficulties could be recovered. In the type of creeping eruption predominating in the South, which has become a problem, considerable difficulty has been experienced in recovering the parasite. One would expect to find an increase in the width of the burrows as the larva advanced, due to the growth of the parasite, but the lesions may advance for months with no apparent increase in size at the active terminal. It often tapers to a faint red line which gradually disappears and leaves one to guess as to the location of the parasite.

THE KIRBY-SMITH CLINIC

On account of the importance of the problem in Florida and upon the request of Dr. J. L. Kirby-Smith, the writer was sent to Jacksonville under the direction of Mr. F. C. Bishopp, of the Bureau of Entomology. Due publicity was given through the press and a ten-day clinic was held. The splendid cooperation of the Florida State Board of Health, the City Board of Health, members of the profession, and the enthusiasm, publicity and hard work of Dr. Kirby-Smith account for a good attendance. The writer saw 179 creeping eruption cases, and counting those whom Dr. Kirby-Smith had in private practice, there were more than 200 cases during this period. Following the clinic investigations extended to environments under which cases had originated and during a period of three months the writer saw at least another 100 persons so affected. Had the weather been of a rainy nature, the total number of cases probably would have reached 500.

EXTENT OF INJURY AND ANNOYANCE

It would be impossible to express the economic importance of this problem in terms of money, loss of



No. 2.—Showing active lesion, one week's duration. A frequent location for creeping eruption.

time or to give the percentage of persons affected, due to the fact that the rural population presents a field from which we have not obtained figures. Also there were numbers of affected persons in the city who did not report to the clinic, as was evidenced by druggists' sales of various remedies.

To ascertain how familiar the public were with this malady the writer has frequently questioned a group of boys who were on the way to the "swimming hole," some of them often showing visible evidence of "when a feller needs a friend." In most cases they had had the affection or could remember that some of the neighbors' children had it. Sometimes it was confused with "ground itch," but usually some of them remembered that the burrows resembled those made by meadow moles under the sod, and that at night the itching was so intense that they could not sleep. Some told of having attracted the attention of the teacher in school, and had to change the location of their desks, while others were more fortunate in that they could conceal the movement of the arms and could scratch without being observed. The state of physical rest or relaxation is the period when the migration of larvae evidently takes place, and it results in loss of sleep at night and failure to concentrate in school work during the day.

One lesion on a small child will cause it to cry during a great portion of the night and be of sufficient annoyance to prevent other members of the household from sleeping. This, of course, depends upon the nervous disposition of the individual. When multiple lesions occur there is considerable reduction in vitality. Sometimes there is fever but usually this is due to an absorption of pus resulting from infections caused by scratching. In such infestations with multiple lesions the flow of pus has been known to be sufficient to necessitate several changes of night clothes and bed linens in one night. Patients become weak, emaciated, have no appetite, lose considerable weight and are unable to sleep.

Grown persons usually have the heaviest infestations, while the great majority of cases are children with few lesions. At times the lesions have been so numerous and partly concealed by the infected portions that it was impossible to count them. They were conservatively estimated in the hundreds. The condition of the skin necessitated months of treatment, as the irritated portions could not be treated with anything which would kill the parasites by coming in contact with them.

One can well imagine the sensation of having hundreds of parasites creeping in a large infected area of the skin which is too sore to be moved, yet itching, with no relief. This condition is partly due to the variety of remedies previously used which with scratching had resulted in partly destroying the epidermis without killing the parasite.

RECOVERY OF THE PARASITE

The normal procedure to recover a parasite would consist of making an incision in front of the end of the terminal of the lesion and then another one on the side of it so that the flap could be lifted and the parasite removed without injury. In this type of creeping eruption we followed the faint line as far as it was visibly possible and with assistance decided upon the location of the parasite. In order to be sure that we obtained it, we made excisions so that the terminal and an area in front of it was removed. On the following day we often found the faint line extending from two to three inches from where the excision was made. This has occurred to us and various surgeons who kindly consented to obtain the parasite. Skin sections were removed when locations would permit and during the summer we obtained about two hundred such sections. Many times we injected mercurochrome with the hope that it might assist the eye in locating the parasite, but the lesion was so small that the track could not be colored. Some of the terminals were frozen with carbon dioxid snow and the parasite made no further migration, but the serum drawn failed to reveal its presence. At other times we have used vacuum cups to draw the serum but did not obtain a parasite. The skin sections were usually larger than a thumb nail and many were of sufficient thickness to include all layers of the skin. They were carefully mounted between slides, secured with silk thread and preserved for serial sections. Superficial examinations failed to reveal the presence of parasites and at the present time sectioning has not been completed.

Had we obtained a parasite of this type of creeping eruption it probably would have been a larval stage of

No. 3.—Showing extensive involvement of skin. Hundreds of active lesions of creeping eruption secondarily infected by scratching.

one whose life cycle and stages were unknown, and it is quite probable that a definite determination would have been difficult. In order to know what parasite we might expect to find, and the conditions under which infestations occurred, an intensive study was made of the environments when the exact location of points of infestations could be determined. A summary is herewith given, as it is not possible to present them in a tabulated form.

ORIGIN OF INFESTATIONS

At least 50 per cent of the cases originate at the beach, slightly above the high tide water mark in front of the board walks where the sand is soft and where children like to dig. The writer found that there is a tendency for persons to attribute the origin to the beach, rather than to admit it was possible for such a disease to originate in the environment of the home. However, it is safe to say that at least one-half the cases come from the beach. The most severe cases did not originate there, but from underneath houses, sometimes many miles from the beach. Plumbers in making installations, perspiring freely, and coming into bodily contact with the moist sand underneath old residences or new ones under construction, became heavily infested. At least 95 per cent of the cases gave information of having been on the damp sand.

There has been no evidence that the disease was caused by conditions inside of houses. Neither can it be connected with the presence of domestic animals and their parasites. Where cases originated away from human habitation the soil failed to show any evidence of pollution by human or animal feces, though in the city one would easily suspect such pollution.

SEVERE INFESTATIONS

Severe infestations can always be traced to a damp sandy soil containing some humus, which is shaded sufficiently to keep the moisture at the surface. The exceptions are places covered with manure or decaying vegetation which would serve equally well in holding the moisture. There is every indication that such places are most favorable for the organisms. Whether they breed there or are brought to the surface by following the moisture is yet an open question.

MINOR INFESTATIONS

When only a few lesions occur the origin of the infestations and places are found to be quite low and where surface drainage seeps into the soil. Such cases occur immediately after rainy weather, and it would appear that the surface drainage from underneath houses and other shaded portions, disseminated the organisms to the low places to the extent that only a few attacked children.

The origin of the disease, whether it has single or multiple lesions, is so definitely related to damp sandy soil that the writer and Dr. Kirby-Smith suggest the popular name "damp sand type of creeping eruption."

CASES WEST OF THE MISSISSIPPI RIVER

The origin of cases west of the Mississippi river is identical with that of those occurring in Florida. They originate in damp sand, and parasites are evidently as difficult to recover from infested patients. Dr. Earl D. Crutchfield, of Galveston, Texas, has furnished the writer with detailed histories of eighteen cases, which leave no doubt that he has been working with the same causation. Dr. Perley Gray's account[9] of cases on the Mexican border is similar. Dr. I. L. McGlasson also reports having about one hundred cases from the section west of San Antonio, Texas, and makes the point that they occur in that section where the hookworm is not present. In the eastern section where the hookworm is prevalent, cases of creeping eruption have not appeared. The published reports of Dr. J. B. Shelmire,[30 32] and his verbal reports to Mr. F. C. Bishopp, who observed cases with the writer in Florida, indicate quite clearly that creeping eruption has the same causation in Dallas, Texas. At Oklahoma City, Dr. Everett S. Lain reports a few cases and the occurrence with damp sand would indicate that in all probability this type of creeping eruption exists as far north as this in the interior.

OTHER REPORTS AS RELATED TO THE "DAMP SAND TYPE OF CREEPING ERUPTION"

In 1922, Dr. H. A. Mood,[23] working in South Carolina, removed a worm from a pricking papule on the right chest of a woman, which had produced the characteristic linear lesion. The worm was 9 millimeters long

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Author's Note.—Since reading this paper in November, the causative parasite of "the-damp-sand-type of creeping eruption" has been recovered by serial sections of skin obtained from five patients and identified as a nematode, microscopic in size. A report of same will be made at the 1925 meeting of the Section of Dermatology of the American Medical Association.

and 1 millimeter wide, and made wave-like movements in blood serum for about one-half hour. The description is said to have corresponded to that given by Tamura, 1921,[37] in which a similar parasite was identified as *gnathostoma siamense.*

The size of the parasite is not characteristic of the one occurring so commonly in Florida, and in observations with Dr. Kirby-Smith the writer has not observed indications of one so large even in cases of long duration.

From reports of the origin of cases, Dr. Kirby-Smith and the writer feel certain that Knowles, (1916), working at Philadelphia,[19] Ketron, (1921), at Baltimore, Maryland,[15] and Klauder and Greenbaum, (1921), at Philadelphia,[18] have seen the type of creeping eruption found in Florida. In histologic sections Knowles demonstrated an oval body with spiny processes on its circumference. The burrows were present in the upper portion of the epidermis between the corneous layer and the rete. The findings of the burrows by Klauder and Greenbaum confirmed those of Knowles, though they did not recover the parasite. Dr. Crutchfield, of Galveston, Texas, encountered burrows but did not recover the parasite.

In 1920, Darier,[2] working in France, demonstrated an oval organism very similar to that of Knowles' but found it in the papillary body. Its burrow was present chiefly in those portions just beneath the epidermis.

At the present writing our sectioning is not complete. We hope that the members of the profession will continue to make excisions when the opportunity presents itself, so that comparative studies can be made. Further, we would like to know if cases reinfested with creeping eruption show any indication that the patient had become sensitized to the parasite, to the extent that unusual swellings accompany increased temperatures and anemic conditions.

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DISCUSSION (Abstract)

Dr. Earl D. Crutchfield, Galveston, Texas.—Dr. Kirby Smith's pictures are all of typical cases. Not all cases of larva migrans show the beautiful characteristics of the linear vesicle. Sometimes, in sensitive individuals, you are not able to see the larvae, but a very large bleb will develop along the line of migration.

In all of our cases we were able to trace the infection to what we call contaminated sand. Galveston Island has been raised about nine or ten feet by pumping in sand and water from the bay and the bayous, then gradually letting it dry off. All of our infection came from shady places, children playing under houses, etc., where the sand is moist.

Dr. Cosby Swanson, Atlanta, Ga.—In middle and north Georgia larva migrans is a rare condition. In Atlanta I see on an average of five or six cases a year, all of which are from the southern part of Georgia or Florida. This disease is rarely recognized except by dermatologists.

Recently I have seen two cases in which the infection

covered the greater part of the body, the eruption being more extensive than those shown. Both patients acquired the infection when they removed their clothing to repair cars while touring Florida. The itching and pain were so intense that it was necessary to give opiates. This past season I have used ethyl acetate on four patients, which treatment was suggested by Dr. Kirby-Smith. Two were cured. The majority of lesions on the other two responded to this treatment but after two or three weeks ethyl chlorid was used on the remaining lesions.

I would like Dr. Kirby-Smith to tell us how long, in his opinion, the larva could live in the skin, without treatment.

Dr. J. Richard Allison, Columbia, S. C.—Dr. Kirby-Smith's paper confirmed my belief that larva migrans or creeping disease, is comparatively common in the South. Four years ago when we first began to see this in South Carolina, and it was considered by most dermatologists to be very rare, we in Columbia made a special effort to recover the parasite, but without success. We see generally twenty to thirty cases during the summer, but this is only a small percentage of the cases in this neighborhood. The general medical men treat a great many and many get well in spite of home remedies.

The patient undoubtedly becomes infected with the parasite from damp, polluted soil. The majority of cases we see are in a mill clinic. Around Columbia, S. C., there are many "sand hill ponds" which are used as swimming pools by a majority of the population. It would appear very probable that the ponds harbor the parasite.

We have tried many remedies. A solution of phosphorous in oil has been claimed by several men to be efficacious. Our results have been disappointing with this method. The injection of iodin into the skin is very painful, causes a severe reaction and usually fails to cure. The cure appears to be worse than the disease. Freezing with ethyl chlorid has proven by far the most satisfactory form of treatment in our hands. The parts involved with the surrounding area should be frozen from one to one and a half minutes. The time factor is by far the most important consideration in the method of treatment. Short exposures will almost invariably be followed by a recurrence.

Dr. J. C. Michael, Houston, Texas.—In the few cases I have seen in Houston, satisfactory results have been obtained with ethyl chlorid, but as Dr. Allison said, the freezing must be thorough. I believe that Dr. Shelmire should be given credit for originating this method of treatment.

Dr. Toulmin Gaines, Mobile, Ala.—I used to have an occasional case of larva migrans and thought it quite a curiosity. Now I see about ten a year, all traceable to infection near watercourses. One case was of a man who was constructing a boat and lay under it on the sand for several hours. Later he was in the same condition as the case shown on the screen by Dr. Kirby-Smith. In using ethyl chlorid it is important to freeze hard an area the size of a half dollar. For the itching I use a drachm each of chloral and camphor to an ounce of vaseline. It eases the itching and may kill the larva if the blister allows it access to the track.

Dr. J. A. Shelmire, Dallas, Tex.—As to Dr. Allison's query as to how long a larva might live in the skin, there is a record in Crocker's "System" of one traveling around for two years before dying. It was my privilege in 1905 to report, I think, the third case in our country. From that time to 1914 I had seen several of these cases and found the treatment very unsatisfactory. In 1914, a boy came to the office with a larva on the dorsum of the foot. I decided to try freezing with carbon dioxid. Finding my tank empty I used ethyl chlorid, and the result was so satisfactory that I have used this remedy in thirty or more cases since then. In all my cases the track of the larva is soon obscured by vesiculation and pustulation except that part made in the forty-eight hours preceding the inspection. I have often wondered how some of the textbook writers get the pictures they give us, with loops and "loop the loops" that would take a Texas larva two weeks or more to make, with all parts of the track as much alike as two peas. For example, see Sutton, page 1069.

Dr. J. N. Roussel, New Orleans, La.—I have practiced here for nearly thirty years and have seen four cases in that time. I take a hard rubber vibrator and beat the larva to death, then cover the area with collodion, and get fairly good results.

Dr. I. L. McGlasson, San Antonio, Tex.—The dermatological section of the Southern Medical Association can be said "to have arrived" with the presentation of Dr. Kirby-Smith's paper. I know of no set of photographs comparable to those presented today.

I have seen perhaps one hundred cases of creeping disease; a very considerable number of which have come from one section of Texas. I have attempted the recovery of larva migrans a few times, but without success. I have added something to Dr. Shelmire's treatment, in that I run a line of collodion around the area which seems to contain the organism and then freeze on the inside of the circle. This has been successful in a large per cent of the cases. One attempt to inject chloroform was successful, but the difficulties in regard to pain, etc., especially in children, made the treatment as suggested by Dr. Shelmire much more satisfactory.

Dr. M. F. Engman, St. Louis, Mo.—In the last few years we have seen several cases of larva migrans in St. Louis, not contracted here, however, but in other parts of the country. I remember two from Arkansas.

In my limited experience I have found the high frequency affluve tube to be all that is necessary to cure the condition. I gently spark the whole area, paying particular attention to the tracks of the parasite.

Dr. Kirby-Smith (closing).—This disease is very prevalent in certain areas shown on the map. Physicians in the territory where infestations are frequent, have had a problem in the treatment of creeping eruption. Aside from the recovery and identification of the causative parasite, the one thing needed has been a quick, painless treatment. I have diligently sought for years for the parasite in the pus, secretion and skin scrapings from the active furrows of the patients, without result. Treatment, also, has been unsatisfactory, especially a quick, painless destruction of the creeping larvae.

In our clinic last summer ethyl acetate was used with success, applied directly to infected areas. We used thick pads of cotton batting, wet with the chemical, and covered this with a rubber tissue envelope. Ethyl acetate was used also in collodion by evaporating the sulphuric ether, and replacing it with ethyl acetate. Re-

frigeration with carbon dioxid snow has proven efficient in my practice, but it is a very painful measure. If you do not freeze where the larva is resting the patient probably will not return after finding his lesion still active.

ANGLE AND DISTANCE FINDER FOR X-RAY THERAPY*

By C. BROOKS WILLMOTT, M.D.,
Louisville, Ky.

Knowing that the best results in x-ray therapy are obtained only by employing the most exact technic in our work, and believing that the arithmetical computation of roentgen dosage (McKee, *Journal of Cutaneous Diseases*, December, 1919) is the best method yet offered for exact measurement, I offer the following simple device for obtaining at once the desired distance and necessary right angle to the treated lesion.

The target, or anode end, of the Coolidge tube being 3½ inches from the circumference by exact measurement, any device must necessarily be scaled to include this, consequently the gauge must measure only actually 4½ inches in height, which, added to the 3½ inches, would give you an actual 8 inch distance.

The following device when completely closed will give you an 8 inch distance, which may be increased by inches or fractions thereof by simply following out the telescoping upright.

By making a cross mark (glass marking pencil) on the circumference of the tube at a right angle from the center of the target, one can adjust the four right angle circumference arms, cross centering on this pencil mark, which, of course, makes it necessary that the base of the device rest flatly over the lesion or surface being treated.

A similar device for treating tinea tonsurans and other conditions where a shorter distance is desired, may be constructed, the telescoping upright including the base, not to measure over three inches.

The cut below will be found to consist of two parts:

Part 1.—A wooden upright 3⅞x¼ in. inlayed into a 3¾x¼ in. base at a right angle.

Part 2.—A hollow telescoping upright 3⅞x½ in., surmounted by a double cross of two inlaid pieces 3¾x⅛ in., so hollowed out as to fit the circumference of the Coolidge tube.

*Round Table Discussion, Section on Dermatology and Syphilology, Southern Medical Association, Eighteenth Annual Meeting, New Orleans, La., Nov. 24-27, 1924.

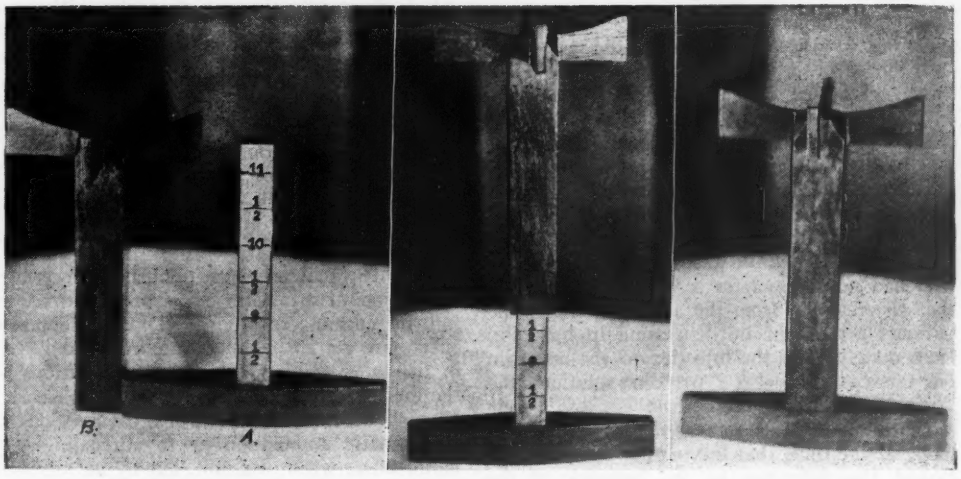

Fig. 1 Fig. 2 Fig. 3

Fig. 1.—Disassembled. (A) Right angular wooden base with graduated upright. (B) Hollow wooden telescoping upright surmounted by a double cross so hollowed out as to fit the circumference of the Coolidge tube and cross center in "cross on surface" made with glass marking pencil opposite target.

Fig 2.—Partly assembled, showing (B) telescoping down toward base (A).

Fig. 3.—Fully assembled, telescoping complete to give eight inches distance. By extension inches or fractions thereof may be measured up to eleven inch distance.

SURGERY

RAILWAY, INDUSTRIAL, GYNECOLOGICAL, OBSTETRICAL AND UROLOGICAL

THE ACTION OF ADRENALIN ON THE PREGNANT HUMAN UTERUS*

By M. PIERCE RUCKER, M.D.,
Richmond, Va.

For the past year and a half I have been greatly interested in the use of sacral anesthesia with novocain.[1] In a number of cases I have been able to obtain graphic records of the uterine contractions by connecting the stem of a Voorhees bag that was within the uterus, to a recording manometer. The usual result that follows the injection of from 30 to 35 c.c. of 1.5 per cent solution of novocain into the sacral canal (extradural) is a diminution or a complete cessation of all contractions for a period of time varying from 20 to 75 minutes (Fig. 1). Occasionally, however, I got an acceleration of the contractions with no diminution of their strength, or even an increase (Fig. 2). The present study grew out of an attempt to find an explanation for this variation.

It is recommended by practically everyone using sacral anesthesia to combine adrenalin with the novocain in order to prolong the anesthesia. Stockel[2] recommended this especially in obstetrics because he thought it lessened the chance of post partum hemorrhage. The proportion that is usually used is 5 minims of adrenalin (1-1000 to 40 c.c. of novocain solution. Occasionally, for some special reason, I have left out the adrenalin. The first patient to whom I gave straight novocain was an extreme neurotic who had not walked for a year. I was afraid that the reaction from the adrenalin that some patients get, might be distressing in her case. Immediately after the injection of the novocain (in this case I used a 2 per cent solution) the "pains" became closer together and their strength was a trifle increased. It seemed unlikely at the time, that leaving out the adrenalin caused the difference in the behavior of the uterus for one is taught that adrenalin is an oxytoxic. For instance, Kurdinowsky,[3] in his classical work upon the isolated dog's uterus, says that adrenalin has a greater effect than anything he knows of. In dilutions of 1-200,000 it gives strong tetanic contractions. It also increases the irritability so that mechanical stimulation gives a much stronger effect in the presence of adrenalin. He has often seen adrenalin give such a strong tetanic contraction as he has noted in no other circumstances. During the time the drug is acting, light touching of the uterine horn causes a prompt, strong contraction of the whole uterus, in which the ligaments and adnexa also take part. Gunn[4] has compared the action of adrenalin and pituitary extract upon the isolated human uterus and tubes. He found that adrenalin had a powerful motor effect upon both tubal and uterine tissue, whereas pituitary extract had no effect upon tubal muscle and a less prompt and marked effect upon uterine muscle. Subsequently, whenever I left adrenalin out of the preparation I obtained the same results. It seemed to me, therefore, that the action of adrenalin upon the pregnant human uterus required further investigation.

It is commonly thought that the action of adrenalin is generally the same as that obtained by sympathetic stimulation. If that be the case, then its action upon the uterus should be, according to Cushny,[5] usually that of stimulation, for he found that in rabbits and pregnant cats, hypogastric stimulation produced powerful contraction of the whole uterus. However, in virgin cats and in one instance in the pregnant rabbit, hypogastric stimulation produced pure inhibition.

The little that has been published concerning the action of adrenalin upon uterine tissue is full of curious variations. Directly opposite effects are gotten in different animals, and even in the same animal with varying conditions of the uterus. Thus Cushney,[5] Dale,[6] and Kehrer[7] have shown that the uterus of a cat responds to sympathetic stimulation or to adrenalin by a motor effect when pregnant, but by an inhibitor effect when non-pregnant. Gunn and Gunn[8] have shown that for the rat and the guinea pig, the effect is inhibitor both for pregnant and non-pregnant animals. Both pregnant and non-pregnant rabbits show a motor response to adrenalin and to hypogastric stimulation. Dale[6] experimented with only two cats late in pregnancy

*Read in Section on Obstetrics, Southern Medical Association, Eighteenth Annual Meeting, New Orleans, La., Nov. 24-27, 1924.

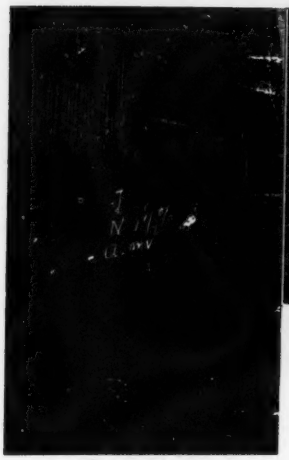

Fig. 1.

Fig. 2.

Fig. 1.—Hysterogram showing the effect of novocain (35 c.c. of 1.5 per cent sol.) with adrenalin (m. 5) upon the strength of uterine contractions. The timer in this and subsequent figures marks minutes and also the line of zero pressure.

Fig. 2.—Hysterogram showing effect of leaving adrenalin out of the preparation for sacral anesthesia. The patient was given a signal with which to indicate subjective pains. There was a cessation of pain for some 15 minutes after the injection, which is indicated by the blurred point in the record. Note that the contractions were increased in both frequency and force.

and in one, adrenalin caused contraction followed by inhibition, and the other, pure contraction. In one virgin monkey he[6] obtained a weak motor effect with adrenalin. Flury[9] finds that adrenalin contracts the guinea pig's uterus *in situ*, but relaxes the isolated uterus. He also finds that adrenalin in dilutions of 1-25,000,000 increased the frequency of contractions of strips of human uterus, but the contractions were somewhat weaker. The tone was increased.

In view of these varying results, it seemed desirable to determine the action of adrenalin upon the human pregnant uterus *in situ*. If Kurdinowsky's[3] and Gunn's[4] observations hold good for the human parturient uterus, then a hypodermoclysis with normal salt solution to which has been added a few minims of adrenalin should prove efficacious in post partum hemorrhage. On the other hand, if adrenalin causes a relaxation, then its injection might increase the hemorrhage.

METHOD

Patients whose labors were induced with a Voorhees bag afforded an opportunity of observing the effect of adrenalin. One patient had the bag placed on account of inevitable abortion and bleeding in the fifth month of pregnancy. All the other cases were at term. The stem of the Voorhees bag was connected with a mercury manometer and a continuous record of uterine contractions was obtained in the manner described elsewhere.[10] My first patient was given two minims of 1-1000 solution of adrenalin hypodermically and showed no effect whatever. The cases cited below were given five minims of the solution hypodermically.

REPORT OF CASES

Case I.—Mrs. G., para 2, aged 25 years, was given 7 c.c. of tincture of digitalis several hours before the bag was placed. Morphin grains 1-6, and hyoscin 1-100 had been given. When the pains were from 32 to 46 millimeters of mercury in strength, the patient was given adrenalin. Immediately the contractions were diminished to from 1 to 6 millimeters of mercury. The effect was apparently over in 16 minutes.

Case II.—Mrs. W., para 1, 37 years of age, had had previously 7 c.c. of tincture of digitalis, 1-6 grain of morphin and 3-200 of hyoscin. Intra-uterine pressure between contractions was 78 millimeters of mercury. The contractions were from 24 to 36 millimeters of mercury in force. After the adrenalin there was cessation of contractions for 6 minutes and then for 8 minutes the contractions were only 9 millimeters. An hour and ten minutes later the patient was given sacral anesthesia without adrenalin and there was no change in the rhythm or force of uterine contractions.

Case III.—Mrs. W., para 1, 22 years old, had had no previous medication. Intra-uterine pressure was 60 millimeters with pains of 36 to 44 millimeters. After adrenalin the contractions were from 12 to 24 millimeters in force. The effect lasted 21 minutes. Sacral anesthesia with novocain and adrenalin caused the entire cessation of pains.

Case IV.—Mrs. B., para 1, was 20 years old. Previous medication had consisted of morphin grains 1-6. Intra-uterine pressure was 17 millimeters with pains from 24 to 36 millimeters. There was no effect after the administration of adrenalin except the skipping of one pain. Sacral anesthesia without the adrenalin produced no apparent change in the force and rhythm of uterine contractions.

Case V.—Mrs. B., para 2, 27 years old, was given a proctoclysis of 5 per cent glucose solution. Intra-uterine pressure was 70 millimeters. The contractions were irregular and of 28 millimeters. Adrenalin caused a cessation of contractions for 30 minutes. One hour later when pains were every five minutes and intra-uterine pressure was 50 millimeters and contractions 20 millimeters, adrenalin was again given. In the next 30 minutes the patient had two pains, one 8 millimeters and the other 10 millimeters in force.

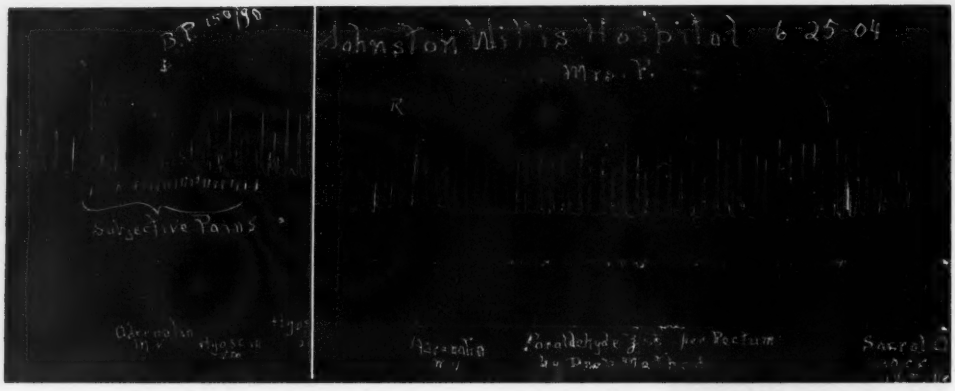

Fig. 3 Fig. 4

Fig. 3.—(Case 6).—In this hysterogram an attempt was made to show when in the course of uterine contractions the patient began and ceased to feel pain, by moving the writing lever away from the drum for a few seconds, thus making a break in the record. The contractions thus studied were marked afterwards. After the adrenalin was given, there was an increased rapidity of the pains but a marked diminution of their force.

Fig. 4.—(Case 7).—This patient showed no effect from being given first adrenalin and then paraldehyde. Sacral anesthesia with novocain and adrenalin produced marked effect upon strength of contractions and uterine tone.

Case VI.—Mrs. H., (Fig. 3), para 1, was 26 years of age. Previous medication consisted of proctoclysis of glucose solution 5 per cent and morphin grains 1-6 hypodermically. Intra-uterine pressure was 60 millimeters and the contractions from 18 to 66. After adrenalin the pains varied from 2 to 4 millimeters for the next 30 minutes.

Case VII.—Mrs. F., (Fig. 4), para 1, age 31, had an intra-uterine pressure of 30 millimeters, and contractions 22 to 40 millimeters. Adrenalin was followed by no effect. Paraldehyde ounce ½ per rectum had no effect. Sacral anesthesia with novocain and adrenalin, produced a marked diminution in the force of pains, but no change in the rate.

Case VIII.—Mrs. T., (Fig. 5), para 6, was 34 years of age. Intra-uterine pressure was 108, and she had contractions of from 22 to 36 millimeters every two minutes. Adrenalin was followed by eight contractions of from 5 to 8 millimeters in the next 26 minutes. The patient signaled them accurately and said they were as severe as they were before the hypodermic was given. Paraldehyde by bowel had no effect.

Case IX.—Mrs. J., (Fig. 6), para 4, age 42 years, had an intra-uterine pressure of 70 millimeters, and contractions from 12 to 34 millimeters. After adrenalin the contractions ranged from 2 to 8 millimeters for 22 minutes. The patient was then given 1-6 grains morphin and later novocain and adrenalin sacrally. After the sacral injection there was a marked diminution of contractions for 23 minutes.

Case X.—Mrs. B., (Fig. 7), age 21, who had had one previous abortion, was bagged on account of an inevitable abortion, and pyelitis. Intra-uterine pressure was 22. Adrenalin had no appreciable effect. She was then given a proctoclysis of glucose solution and 15 grains of chloral per rectum, later 5 grains of quinin by mouth. Finally she was given 0.5 c.c. pituitrin hypodermically and if there was any effect at all there was a lessening of the force of the contractions.

Case XI.—Mrs. V. G., para 6, 37 years of age, had glucose solution by Murphy drip. Intra-uterine pressure was 84 millimeters, and contractions were 9 millimeters. After adrenalin all contractions ceased for 26 minutes. During this time she felt six pains.

Case XII.—Mrs. H. had an intra-uterine pressure of 60 millimeters with contractions 30 mm. After adrenalin was given the contractions varied from 8 to 12 millimeters for 12 minutes. Sacral injection of novocain and adrenalin was followed by a similar effect that lasted 40 minutes.

Case XIII.—Mrs. J., para 2, age 27 years, had had previous medication of morphin grains 1/6, and hyoscin grains 1/200. Intra-uterine pressure was 36 millimeters with contractions ranging from 24 to 68 millimeters. After adrenalin was injected the pains varied from 3 to 14 millimeters for the next 17 minutes. Another 1/200 grain of hyoscin was given and then sacral anesthesia with novocain and adrenalin. There was a cessation of all pain for 22 minutes.

Case XIV.—Mrs. P., (Fig. 8), para 2, age 35, had had 7 c.c. tincture of digitalis, 1/6 grain morphin, 1/100 hyoscin, and proctoclysis with 5 per cent glucose solution. Intra-uterine pressure was 36 millimeters and the contractions were from 15 to 30 millimeters. Adrenalin had no effect except for the skipping of one contraction.

Case XV.—Mrs. B., para 2, was 32 years old. Previous medication was 6 c.c. of tincture of digitalis, 1/6 grain morphin, 1/100 grain hyoscin and proctoclysis of 5 per cent glucose solution. Intra-uterine pressure was 110 millimeters. Contractions varied from 16 to 22 millimeters. Adrenalin caused a cessation of contractions for 8 minutes and then pains of 4 millimeters for 5 minutes. Later novocain and adrenalin intrasacrally caused a diminution of pains to 6 millimeters for 12 minutes when the patient was taken to the delivery room.

Case XVI.—Mrs. W., para 1, age 26 years, had an intra-uterine pressure of 90 millimeters and contrac-

Fig. 5

Fig. 5.—(Case 8).—Hysterogram with a faster moving drum (approximately 1 minute to a centimeter). Note the accuracy with which the patient indicated her subjective pains, compared with the beginning of each uterine contraction.

tions of 48 to 56 millimeters. After the adrenalin the contractions were 30 millimeters for 10 minutes. The bag was expelled 15 minutes later.

Case XVII.—Mrs. O'C., para 1, age 27 years, had had 1/6 grain morphin, and 3/200 hyoscin. Intra-uterine pressure was 90 millimeters with contractions of 18 or 20 millimeters. Adrenalin caused a cessation of contractions for 26 minutes.

Case XVIII.—Mrs. H., para 2, age 32 years, had had 1/6 grain morphin, 7 c.c. tincture of digitalis, 3/200 grs. hyoscin and a proctoclysis of 5 per cent glucose solution. Intra-uterine pressure was 110 millimeters with contractions of from 30 to 40 millimeters. Adrenalin caused a cessation of contractions but not of pain, for 9 minutes. Novocain and adrenalin sacrally stopped contractions and pain for a similar length of time.

Case XIX.—Mrs. C., para 1, was 30 years old. Previous medication consisted of 8 c.c. tincture of digitalis, 1/6 grain morphin, 1/100 hyoscin and proctoclysis of 5 per cent glucose solution. Intra-uterine pressure was 120 millimeters, and contractions were 44 millimeters. After adrenalin the contractions were from 10 to 14 millimeters for 27 minutes.

Case XX.—Mrs. P., para 1, age 28. Previous medication consisted of 6 c.c. tincture of digitalis, 1/6 grain morphin, 3/200 hyoscin. Intra-uterine pressure was 116 millimeters with contractions of from 20 to 30 millimeters. After the adrenalin the contractions were from 4 to 10 millimeters for the next 16 minutes.

RESULTS

Of the twenty cases, sixteen showed a prompt cessation or a diminution in the strength of uterine contractions for 9 to 30 minutes after a hypodermic administration of five minims of adrenalin. In four cases there was no demonstrable effect. In no case was there an increase in the force or frequency of uterine contractions. In those patients where there was a period of absence of demonstrable contractions, subjective pains continued at regular intervals. This is well shown in Fig. 9. The patient was given a signal button connected with an electric magnet, and was instructed to signal whenever she felt a pain. The magnet, as you see, recorded subjective pains at regular intervals although there was no increase of intra-uterine pressure at these times.

Whenever adrenalin was left out of the novocain preparation for the sacral anesthesia, the uterine contractions continued as before and in some cases, even with increased vigor (Fig. 2), but when 5 minims of the 1-1000 solution of adrenalin were added to 40 c.c. of the 1.5 per cent novocain solution, there was a cessation of uterine contractions for 20 to 50 minutes as previously noted. Bonar and Meeker[11] observed this clinically. They found no difficulty in doing versions under sacral anesthesia provided the operation was done in the first 20 minutes. After this the uterine tone was such that it made version difficult or impossible. My experience with version under sacral anesthesia accords with theirs in this particular. Recently in several instances when I found the fundus contracted I have given a hypodermic of 5 minims of adrenalin (1-1000) and have felt the uterus relax so as to make the version easy.

The duration of the inhibitor effect of the adrenalin and novocain given sacrally has been somewhat longer than that of the adrenalin given alone hypodermically. According to Symes-Thompson,[12] the effect of the adrenalin is heightened when it is combined with novocain, certainly in so far as the reactions[13] are concerned. This may also account for the increased duration of the inhibitor effect when the adrenalin is given into the sacral canal combined with novocain. In one instance (Fig. 4) I obtained an inhibitor effect from the use of novocain and adrenalin sacrally when the same dose of adrenalin alone hypodermically produced no effect.

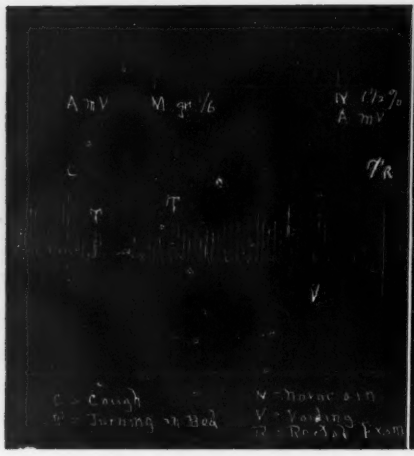

Fig. 6

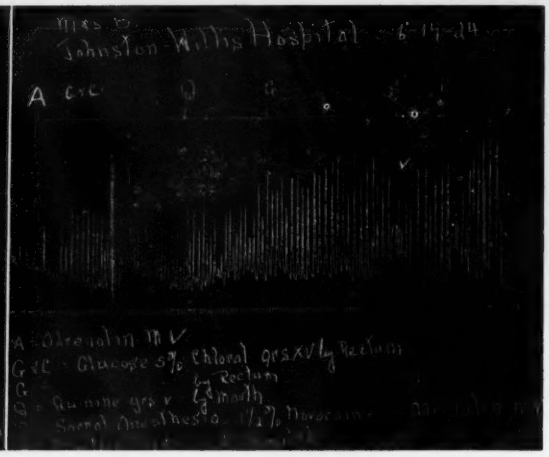

Fig. 7

Fig. 6.—(Case 9).—Hysterogram showing a very similar action of adrenalin hypodermically and the same dose of adrenalin with 35 c.c. of novocain solution (1.5 per cent) sacrally.

Fig. 7.—(Case 10).—Hysterogram of uterus (4 months pregnant) that is very insensitive to many drugs. There was no apparent effect from adrenalin (hypo) chloral hydrates grs. xv by rectum, quinin grs. v by mouth, 35 c.c. of 1½ per cent novocain with 5 m. adrenalin sacrally and pituitrin ½ c.c. hypodermically.

DISCUSSION

Whether adrenalin is given hypodermically or sacrally there is an inhibitory effect upon contraction of the human pregnant uterus in the great majority of cases. This is contrary to what one would expect from experimental work with this substance. In all animal work except that done upon rats and guinea pigs, the pregnant uterus has responded by motor effect to either sympathetic stimulation or the exhibition of adrenalin. The response of the various animals is shown in the following table:

ACTION OF ADRENALIN

Animal	Non-Pregn't Uterus	Pregnant Uterus	Investigator
Rat	—	—	Gunn and Gunn[8]
Guinea pig	—	—	Gunn and Gunn[8]
Guinea pig		— +	Sugimoto[17] (intravenous +)
Guinea pig		— +	Flury[9] (excised — *in situ* +)
Cat	—	+	Cushny,[5] Dale,[6] Kehrer[7]
Rabbit	+	+	Langley and Anderson[14]
Ferret	+		Gunn and Gunn[8]
Dog	+		Gunn and Gunn[8]
Dog		+	Kurdinowsky[3]
Monkey	+		Dale[6]
Human (excised)		+	Gunn[4]

Inhibitor — Motor +

The excised human uterus, according to Gunn,[4] contracts more markedly and more promptly to epinephrin than it does to pituitary substance. Why, then, do we get an inhibitor response of the intact human uterus when five minims of adrenalin are given hypodermically? A number of explanations present themselves. The first is that of environment. Flury[9] found such a difference in working with the pregnant guinea pig uterus. The excised pregnant uterus responded to adrenalin by inhibition, whereas the organ *in situ* gave a motor response.

Second, the question of dosage is an important one. Cannon and Lyman,[15] and Hoskins and McClure[16] have shown that minute doses of adrenalin cause a relaxation of blood vessels in contradistinction to the well known contraction that follows ordinary doses. Gunn and Gunn[8] offer this as an explanation of the motor effect upon the pregnant guinea pig uterus that Sugimoto obtained by intravenous administration of adrenalin, an effect that they did not obtain with the dosage they used.

Third, the difference in method of observation may be an explanation. Some investigators (Kurdinowsky[3] and Cushny[5]) relied upon direct observation. The uterus was seen to harden and blanch. Others (Flury[9] and Gunn and Gunn[8]), used strips of tissue as in a muscle preparation, and obtained graphic records. It is quite possible for these phenomena to occur without raising the intra-uterine pressure or increasing the expulsive efforts of the intact organ. The fact that my patients indicated that they felt rhythmic pains although there was little if any demonstrable increase in intra-uterine pressure, rather supports this idea. Cushny,[5] in his work upon the movements of the cat's uterus observed tight, band-like contractions with no

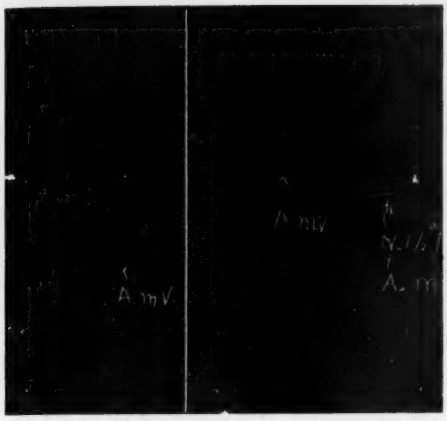

Fig. 8 Fig. 9

Fig. 8.—(Case 14). Hysterogram showing no effect of adrenalin.

Fig. 9.—(Case 18). Very similar effect from a hypodermic of adrenalin and novocain and adrenalin given sacrally, except that the latter stopped subjective pain as well as contraction.

progression of the fetus. It was only when this circular contraction was combined with contraction of the longitudinal fibers that any movement of the contents of the uterine horns was noted.

A fourth explanation depends upon the assumption that the sympathetic nerves contain both motor and inhibitor fibers. Cushny[5] offered this explanation for the different responses he obtained, notably, in the cat's uterus. He assumed that in the virgin state the cat's uterus was influenced chiefly by the inhibitor fibers, but that during pregnancy and generally afterwards, the uterine muscle became more sensitive, and the action of the motor fibers prevailed and masked the inhibitor action. This fits in well with my observations upon the action of adrenalin upon the human pregnant uterus. In the small dosage of five minims hypodermically or intra-sacrally, the inhibitor fibers respond, just as in the relatively less sensitive virgin cat's uterus. But in larger doses, as when Gunn[4] exposed excised human uterine tissue to the direct action of adrenalin in strengths of 1-20,000,000, the motor fibers prevail. Flury,[9] in dilutions of 1-25,000,000, obtained an increased frequency, but somewhat weaker contractions of strips of human uterus. Sugimoto's[17] observation that the pregnant guinea pig's uterus responds by motor effect when adrenalin is given intravenously further supports this idea. Were I an investigator instead of a mere observer, I should like to try intravenous administration or a larger dose of adrenalin hypodermically.

The fact that subjective pains are not influenced by adrenalin even when the full inhibitor effect is obtained, is no bar to this idea. The majority of anatomists and physiologists who have investigated the innervation of the uterus agree that the longitudinal muscle fibers of the fundus are under the control of the spinal nerves, while the circular fibers are under sympathetic control. The continued rhythmic action of the longitudinal fibers, even in the presence of complete inhibition of the circular fibers, would cause the periodic subjective pain that many of my patients noted. What the effect of contraction of the longitudinal fibers without the support of the circular fibers would have upon the intra-uterine pressure is an open question. It is conceivable, however, that the expulsive force of the uterus is due to the proper coordination of both sets of fibers. Cushny,[5] as already noted, mentions the futile action of the circular fibers when unsupported by the contraction of the longitudinal fibers. The reverse of this, i. e., that the longitudinal fibers acting alone have no expulsive action, seems plausible.

SUMMARY

In a series of twenty cases, nineteen of which were at term, and one in the fifth month of pregnancy, the hypodermic administration of five minims of adrenalin solution (1-1000) caused a marked lessening of the force of uterine contractions, as measured by intra-uterine pressure in 80 per cent of the cases. Four cases showed no appreciable effect. No case showed an increase in the force of uterine contractions. Adrenalin in the dosage used, had no effect upon subjective pains. Even where there was complete cessation of all contractions that could be measured by variations in intra-uterine pressure, the patient experienced periodic pains as before.

In three other cases, in which I was attempting to do a version under sacral anesthesia, and was hindered by a tightly contracted fundus, a hypodermic administration of 5 minims of adrenalin in two instances produced prompt and definite relaxation of the uterus that made the operation easy. One of these had a fairly well defined Baudl's ring, which disappeared completely.

CONCLUSIONS

(1) Adrenalin in doses of five minims hypodermically, has no oxytoxic action upon the human pregnant uterus.

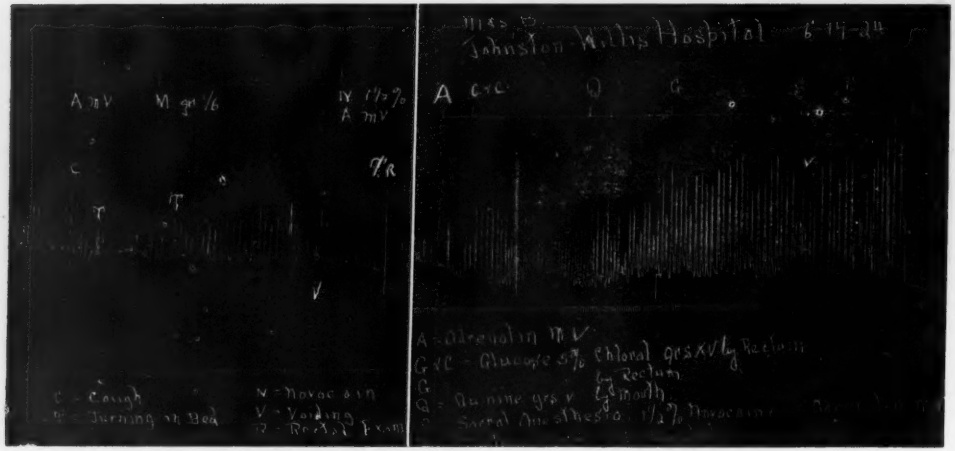

Fig. 6 Fig. 7

Fig. 6.—(Case 9).—Hysterogram showing a very similar action of adrenalin hypodermically and the same dose of adrenalin with 35 c.c. of novocain solution (1.5 per cent) sacrally.

Fig. 7.—(Case 10).—Hysterogram of uterus (4 months pregnant) that is very insensitive to many drugs. There was no apparent effect from adrenalin (hypo) chloral hydrates grs. xv by rectum, quinin grs. v by mouth, 35 c.c. of 1½ per cent novocain with 5 m. adrenalin sacrally and pituitrin ½ c.c. hypodermically.

DISCUSSION

Whether adrenalin is given hypodermically or sacrally there is an inhibitory effect upon contraction of the human pregnant uterus in the great majority of cases. This is contrary to what one would expect from experimental work with this substance. In all animal work except that done upon rats and guinea pigs, the pregnant uterus has responded by motor effect to either sympathetic stimulation or the exhibition of adrenalin. The response of the various animals is shown in the following table:

ACTION OF ADRENALIN

Animal	Non-Pregn't Uterus	Pregnant Uterus	Investigator
Rat	—	—	Gunn and Gunn[8]
Guinea pig	—	—	Gunn and Gunn[8]
Guinea pig		— +	Sugimoto[17] (intravenous +)
Guinea pig		— +	Flury[9] (excised — *in situ* +)
Cat	—	+	Cushny,[5] Dale,[6] Kehrer[7]
Rabbit	+	+	Langley and Anderson[14]
Ferret	+		Gunn and Gunn[8]
Dog	+		Gunn and Gunn[8]
Dog		+	Kurdinowsky[3]
Monkey	+		Dale[6]
Human (excised)		+	Gunn[4]

Inhibitor — Motor +

The excised human uterus, according to Gunn,[4] contracts more markedly and more promptly to epinephrin than it does to pituitary substance. Why, then, do we get an inhibitor response of the intact human uterus when five minims of adrenalin are given hypodermically? A number of explanations present themselves. The first is that of environment. Flury[9] found such a difference in working with the pregnant guinea pig uterus. The excised pregnant uterus responded to adrenalin by inhibition, whereas the organ *in situ* gave a motor response.

Second, the question of dosage is an important one. Cannon and Lyman,[15] and Hoskins and McClure[16] have shown that minute doses of adrenalin cause a relaxation of blood vessels in contradistinction to the well known contraction that follows ordinary doses. Gunn and Gunn[8] offer this as an explanation of the motor effect upon the pregnant guinea pig uterus that Sugimoto obtained by intravenous administration of adrenalin, an effect that they did not obtain with the dosage they used.

Third, the difference in method of observation may be an explanation. Some investigators (Kurdinowsky[3] and Cushny[5]) relied upon direct observation. The uterus was seen to harden and blanch. Others (Flury[9] and Gunn and Gunn[8]), used strips of tissue as in a muscle preparation, and obtained graphic records. It is quite possible for these phenomena to occur without raising the intra-uterine pressure or increasing the expulsive efforts of the intact organ. The fact that my patients indicated that they felt rhythmic pains although there was little if any demonstrable increase in intra-uterine pressure, rather supports this idea. Cushny,[5] in his work upon the movements of the cat's uterus observed tight, band-like contractions with no

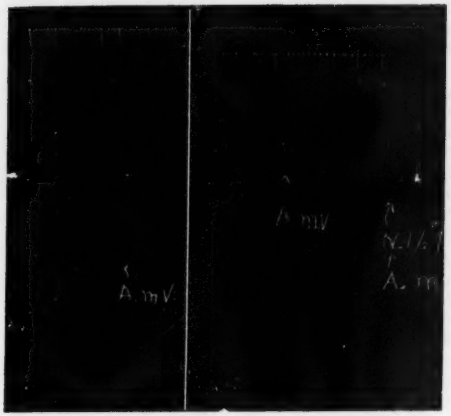

Fig. 8 Fig. 9

Fig. 8.—(Case 14). Hysterogram showing no effect of adrenalin.

Fig. 9.—(Case 18). Very similar effect from a hypodermic of adrenalin and novocain and adrenalin given sacrally, except that the latter stopped subjective pain as well as contraction.

progression of the fetus. It was only when this circular contraction was combined with contraction of the longitudinal fibers that any movement of the contents of the uterine horns was noted.

A fourth explanation depends upon the assumption that the sympathetic nerves contain both motor and inhibitor fibers. Cushny[5] offered this explanation for the different responses he obtained, notably, in the cat's uterus. He assumed that in the virgin state the cat's uterus was influenced chiefly by the inhibitor fibers, but that during pregnancy and generally afterwards, the uterine muscle became more sensitive, and the action of the motor fibers prevailed and masked the inhibitor action. This fits in well with my observations upon the action of adrenalin upon the human pregnant uterus. In the small dosage of five minims hypodermically or intra-sacrally, the inhibitor fibers respond, just as in the relatively less sensitive virgin cat's uterus. But in larger doses, as when Gunn[4] exposed excised human uterine tissue to the direct action of adrenalin in strengths of 1-20,000,000, the motor fibers prevail. Flury,[9] in dilutions of 1-25,000,000, obtained an increased frequency, but somewhat weaker contractions of strips of human uterus. Sugimoto's[17] observation that the pregnant guinea pig's uterus responds by motor effect when adrenalin is given intravenously further supports this idea. Were I an investigator instead of a mere observer, I should like to try intravenous administration or a larger dose of adrenalin hypodermically.

The fact that subjective pains are not influenced by adrenalin even when the full inhibitor effect is obtained, is no bar to this idea. The majority of anatomists and physiologists who have investigated the innervation of the uterus agree that the longitudinal muscle fibers of the fundus are under the control of the spinal nerves, while the circular fibers are under sympathetic control. The continued rhythmic action of the longitudinal fibers, even in the presence of complete inhibition of the circular fibers, would cause the periodic subjective pain that many of my patients noted. What the effect of contraction of the longitudinal fibers without the support of the circular fibers would have upon the intra-uterine pressure is an open question. It is conceivable, however, that the expulsive force of the uterus is due to the proper coordination of both sets of fibers. Cushny,[5] as already noted, mentions the futile action of the circular fibers when unsupported by the contraction of the longitudinal fibers. The reverse of this, i. e., that the longitudinal fibers acting alone have no expulsive action, seems plausible.

SUMMARY

In a series of twenty cases, nineteen of which were at term, and one in the fifth month of pregnancy, the hypodermic administration of five minims of adrenalin solution (1-1000) caused a marked lessening of the force of uterine contractions, as measured by intra-uterine pressure in 80 per cent of the cases. Four cases showed no appreciable effect. No case showed an increase in the force of uterine contractions. Adrenalin in the dosage used, had no effect upon subjective pains. Even where there was complete cessation of all contractions that could be measured by variations in intra-uterine pressure, the patient experienced periodic pains as before.

In three other cases, in which I was attempting to do a version under sacral anesthesia, and was hindered by a tightly contracted fundus, a hypodermic administration of 5 minims of adrenalin in two instances produced prompt and definite relaxation of the uterus that made the operation easy. One of these had a fairly well defined Baudl's ring, which disappeared completely.

CONCLUSIONS

(1) Adrenalin in doses of five minims hypodermically, has no oxytoxic action upon the human pregnant uterus.

(2) Twenty per cent of cases showed no effect from this dosage.

(3) Eighty per cent of cases showed an inhibitor effect, lasting from nine to thirty minutes, immediately after the hypodermic injection of 5 minims of 1-1000 solution of adrenalin.

(4) Adrenalin in the presence of novocain seems to have a greater inhibitor effect upon the human pregnant uterus, than it does when used alone.

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DISCUSSION (Abstract)

Dr. John B. Haskins, Chattanooga, Tenn.—I wish the essayist would give us in a few words his opinion of trans-sacral anesthesia and in how many cases he has used it.

Dr. S. P. Oldham, Owensboro, Ky.—Of the three approaches to the sacral canal, namely: trans-sacral, presacral and caudal, I greatly prefer the caudal, because of its ease and safety. The trans-sacral requires numerous punctures in the sacral foramina, and is difficult to execute. The presacral has the disadvantage of going through the perineum. The caudal canal is safer and easier, except in distortion of the sacral canal.

A 2 per cent procain with epinephrin gave so short an anesthesia that I added quinin and urea hydrochlorid which prolonged the anesthesia materially, causing it to last for hours and often days and in the multipara lessening the postpartum pain. It is efficient in 85 to 90 per cent of the cases, which is very satisfactory indeed.

The great advantage of sacral anesthesia is that it requires no anesthetist and relieves pain. While it sometimes stops the uterine contractions, they return with full vigor, and should they not return pituitrin reestablishes them.

Lastly, to have the patient conscious, is of great assistance to the obstetrician. The only objection is sciatic neuralgia, which occasionally lasts for a short period, but invariably disappears.

Dr. Rucker (closing).—I have had very little experience with trans-sacral anesthesia. I have used it several times when I was not able to outline the sacral hiatus for sacral or caudal anesthesia. I think the effect is about the same in either case. Bonar and Meeker's conclusions are that you are more apt to get anesthesia with the trans-sacral method than with the sacral. The technic is more difficult and I do not advise it ordinarily for obstetrics. The patients object to having so many punctures in their backs. If you can get it with one puncture it is better than to use trans-sacral. In caudal or sacral anesthesia I have gotten relaxation in something over 95 per cent of the cases and in about 90 per cent of the cases I have gotten very satisfactory anesthesia. You get relaxation in a little larger percentage of the cases than you do anesthesia. I have found that every once in a while a case will disappoint you, less than one out of ten.

I would like to ask Dr. Oldham if he has had any trouble with the bladder in the cases in which he combined quinin and urea with the procain.

PROLAPSE OF THE UTERUS: ITS TREATMENT*†

By QUITMAN U. NEWELL, M.D., F.A.C.S., St. Louis, Mo.

Prolapse of the uterus is of vital importance both to the obstetrician and the gynecologist: To the obstetrician, because, in most cases he is to share the responsibility for its presence; and to the gynecologist because he must exercise good judgment in selecting the proper treatment to effect a cure.

The majority of cases of prolapse of the uterus are seen in women who have borne children, the condition being the result of damage caused by the passage of the child through the pelvis. This damage results in prolapse of the uterus, usually with accompanying rectocele and cystocele.

The lacerated pelvic floor is not the direct

*From the Department of Gynecology, Washington University Medical School and Barnes Hospital.

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cause of the prolapse. There are many cases of lacerated perineum of long standing in which the uterus is well up in the pelvis and in good position, but it is natural to suppose that it has a great part to play in most cases, as the floor acts as a support to the pelvic contents and when it has been damaged, with damage of the structures above the levator ani group, the uterus and other organs will certainly give way and come to the vaginal outlet. The next layer above the levator muscles is the endopelvic layer of the pelvic fascia, the main supporting fascia of the uterus and bladder. On the cadaver one can easily demonstrate the pelvic fascia as a direct continuation of the fascia of the abdominal wall, placed between the muscles and peritoneum. The relative position is identical and the visceral layer passes inward from the pelvic walls upon the upper surface of the levator ani muscle and forms a fascial diaphragm which closes the pelvic outlet. This is often called the pelvic diaphragm. It arises from the symphysis and pubic ramus; from the symphysis at about the level of the junction of the lower and middle thirds. It passes under the bladder and forms the anterior ligaments of the bladder. It surrounds the urethra and is intimately connected with the base of the bladder. It sends numerous fibers upward along the walls of the bladder as well as downward along the urethra. The fascia passing under the base of the bladder is closely connected with the anterior wall of the supravaginal cervix and it helps to form the anterior vaginal fornix. This part of the fascia is very plain and is often called the "anterior true ligament of the bladder." It holds the bladder and urethra close to the symphysis.

The next part of the pelvic fascia arises from the pubic ramus and the white line, first at the level of the top of the obturator foramen and from the inner surface of the spine of the ischium. It runs inward above the levator ani muscles toward the vagina, bladder, cervix and rectum, and divides into the vesical, vesicovaginal, rectovaginal and rectal layers. The posterior part of the fascia here surrounds the rectum and follows its walls as the rectal layer, giving some support to the upper part of the posterior vaginal wall where it is in relation to the anterior wall of the rectum. This part constitutes the rectovaginal layer. The anterior position of this fascia is stronger and thicker than the rectal portion and constitutes the vesicovaginal layer. As it runs inward toward the viscera it divides into numerous layers and becomes intermixed with loose connective tissue which makes the demonstration of the whole fascia almost impossible, close to the viscera. Nevertheless, the continuity can be shown and the different layers followed, to lose themselves upon the walls of the viscera or to join the fascia of the other side. It is connected to the sides of the bladder and continuous with the anterior fibers of the fascia which pass under the base of the bladder. It passes across the pelvis between the anterior vaginal wall and the base of the bladder and is attached to the cervix uteri and the lateral vaginal fornices, above which it passes to reach the cervix and to become continuous with the rectovaginal layer between the posterior vaginal fornix and the rectum and below the posterior cul-de-sac of peritoneum.

In Cunningham's "Anatomy" the fascia is described in connection with the female pelvis as the endopelvic fascia and is divided into an upper portion attached to the upper part of the vagina and cervix, in front of these passing between the vagina and bladder to reach the mesial plane and lose itself upon the walls of the viscera. The lower layer is that part of the fascia which follows the levator ani muscle and is inserted into the perineal body. The relation of the viscera to the pelvic fascia is such that the bladder rests upon the upper surface of the fascia in front. The vagina, owing to the backward and upward direction of its axis, passes through the planes of the fascia at an acute angle so that its anterior wall which is facing upward and forward is in relation to the under surface of the fascia at the part upon which the bladder rests. Behind this the fascia passes obliquely across the sides of the vaginal fornices and over the top of them, being attached to the cervix, and the posterior vaginal wall being longer than the anterior, is continued back to pass through the plane of the fascia behind the cervix. In this way the vagina is almost altogether below the plane of the fascia and has its attachment by fibers to the under surface. At the same time the fascia sends numerous fibers to all parts of the vaginal wall. The cervix uteri definitely passes through the fascia. The supravaginal portion is above the vaginal portion below the plane of the fascia, but owing to the oblique direction of the axis of the uterus running forward, there is a greater attachment in front of the plane of the broad ligaments than behind, so that the vesicovaginal layer practically forms a sling across the pelvis, attached to the sides of the cervix, upon which the uterus lies when anteverted, the fundus resting upon the upper surface of the bladder.

Of the ligaments of the uterus the sacrouterine are most concerned in maintaining the

position of the uterus and the round and broad ligaments play very little part in supporting it. Retrodisplacement of the uterus is claimed by some to be a predisposing cause in prolapse. This I do not believe to be the case. But after a separation of the pelvic diaphragm when the uterus begins to descend, we have a retrodisplacement which is really the beginning stage of prolapse. It is a concomitant and not a predisposing cause, although it is a development in all cases.

Prolapse of the uterus may be seen in the following conditions:

(1) Prolapse in the new born.

(2) Prolapse in the unmarried.

(3) Prolapse after childbirth where the levator muscles have been lacerated.

(4) Prolapse after childbirth where the levator muscles have not been lacerated but where a diastasis is present.

(5) Prolapse after childbirth where the levator muscles are intact but where a separation of the vesicopubic fascia is present.

Prolapse in the new born is sometimes seen. It is most often a prolapse of the vaginal mucosa, not the uterus, and is a developmental defect.

Prolapse in the unmarried is not very common. When seen it is usually the result of faulty innervation to the structures of the pelvis. When abnormal intra-abdominal pressure is exerted upon the uterus there is a resultant hernia or prolapse, and this is the most difficult type in which to get a complete cure. Much has been said and written about this type of prolapse, classifying it along with cases of spina bifida occulta. I shall confine my remarks to prolapse occurring after childbirth, as it is with this type that the obstetrician is most concerned.

Prolapse of the uterus is in reality a hernia in which the pelvic fascia has separated allowing the uterus to slide downward. It depends primarily upon injuries in childbirth especially to the upper pelvic floor. As described in the anatomy of the pelvic fascia you will note that the most important supporting structures of the upper pelvic floor concentrate about the cervix just as the structures of the lower plane or pelvic floor concentrate about the perineal body.

Then, the first requisite in prolapse is injury to the fascia about the cervix followed by increased abdominal pressure which causes the uterus first to become retroverted and as time goes on to begin to descend through the pelvis and perhaps protrude from the vulva to a considerable extent. It is not necessary that the pelvic floor be lacerated or relaxed, but it is no doubt a great factor in the majority of cases. After the uterus once begins to descend and the pelvic floor is markedly relaxed or lacerated there is nothing to support the upper structures and the condition of prolapse is greatly increased.

How can the obstetrician prevent prolapse? Regardless of all skill in the management of labor there will be some unavoidable cases of prolapse. Many procedures have been recommended to prevent the condition; from that of the old-time obstetrician who allowed the woman to deliver her baby spontaneously, to the modern method of delivery with forceps under anesthesia. I have seen more cases occurring after prolonged spontaneous delivery than I have after forceps delivery, although forceps delivery has been greatly criticized. If forceps are improperly used they will mutilate the pelvis and thus pave the way for a prolapse. There is, for instance, nothing more inhuman to try to deliver a woman with forceps when the cervix is not fully dilated, the head is high in the pelvis and incompletely rotated, and the bladder filled with urine. Under these conditions the physician will by main force drag the baby through the cervix and pelvic canal and completely overstretch and lacerate the fascia of the upper pelvis, which in a majority of cases will fail to return to normal. He will injure the fascia about the cervix, especially that anterior to it and close behind the pubis, the vesicopubic fascia which tends to keep the bladder in position. I know of nothing better in obstetrics than forceps delivery done properly under anesthesia. The cervix must be fully dilated, the head in nearly perfect rotation, the rectum and bladder empty, and the pelvic floor well dilated by hand and lubricant, to stretch the perineal muscles so that no resistance will be encountered. It is claimed that there is danger of over stretching the perineal muscles and thus causing a paralysis of the levator group which then will fail to return to its normal state. This I do not believe, as the stretching does not exceed ten minutes and any paralysis which may occur will be only temporary. More relaxed pelvic floors are caused by allowing the head to effect its own dilatation in a slow manner than by manual dilatation of the vaginal tract.

Some prefer episiotomy to vaginal dilatation. I use episiotomy occasionally when it seems

indicated but do not make it a routine in preference to vaginal dilatation.

The treatment of prolapse of the uterus is of great importance to the gynecologist, and no fixed method can be followed. Numerous types of abdominal and vaginal operations have been devised but none fits all cases. In the child-bearing age the different operations recommended are very unsatisfactory, but if the woman is near, or at her menopause the vaginal operation, the so-called interposition operation (Watkins-Wertheim or Mayo) is very satisfactory and cures most cases.

Uterine prolapse of a mild degree in the child-bearing woman needs no treatment. When treatment is indicated, the methods range from the support of the uterus and bladder with one of the many varieties of pessary to one of the several operations recommended. Many things have to be taken into consideration, the most important of which I will try to outline. Uterine prolapse, although a source of many discomforts, does not threaten life. If an operation is to be done it is important to perform the one that has the best results, bearing in mind the patient's chances of child-bearing, and whether or not the operation is to be abdominal or vaginal.

If a woman is in the child-bearing age, is less than 38-40 years old, and is desirous of more children, the operation of choice would be both abdominal and vaginal. One should repair the cystocele and rectocele by a plastic operation from below, then shorten the ligaments of the uterus by one of the many methods, paying special attention to the sacro-uterine from above. This operation when properly performed gives good results but has the great disadvantage that there may be a recurrence if more children are borne. However, this is not always the case and I have found the pelvis in good condition after two or three deliveries.

If the patient is near or at the menopause the interposition operation is almost ideal. If the patient is near the menopause, the tubes should be resected in order to prevent the possibility of pregnancy which may be a serious complication.

In performing the interposition operation the main thing is to take care of the always troublesome cystocele. Prolapse of the uterus is a simple thing to cure, by hysterectomy, but the cure of the accompanying cystocele is very difficult. When possible the uterus is utilized to support the bladder, and the uterus must not be too small or too large. If it is too small it will not completely interpose between the bladder and anterior vaginal wall, and there will be a recurrence of the cystocele. If it is too large, it will not remain interposed and very shortly there will be a prolapse of the uterus, fundus downward. For the cases where the uterus is too large, many modifications have been suggested; for example, amputation of the cervix or supravaginal hysterectomy interposing the cervix, or trimming the uterus to a smaller size bisecting it either longitudinally or transversely and suturing it. The most popular modification and the one which undoubtedly gives the best results is that suggested by Mayo in which the uterus is removed and the broad and round ligaments are brought down under the bladder and sutured to each other swinging the bladder in a hammock, so to speak.

It is very essential in all interposition operations for prolapse of the uterus that a high repair of the pelvic floor be performed either at the time of the operation or a very short time thereafter.

Sometimes one encounters prolapse of the uterus necessitating abdominal hysterectomy. The results are fairly satisfactory, provided special care is taken to repair the vesicopubic fascia, support the vagina with the ligaments of the uterus, then repair the pelvic floor.

Some men continue to operate for prolapse of the uterus after the menopause by the abdominal route, either performing a supravaginal hysterectomy and anchoring the cervix to the anterior abdominal wall, or suturing the uterus to the anterior abdominal wall rather high up, taking all the slack out of the uterus. These operations to me seem only cosmetic. They should not be performed as they have no curative properties and if much intra-abdominal pressure is applied there will be a return of the prolapse with its cystocele. In this type of operation no attempt is made to repair the separated pelvic fascia which is the main support of the pelvic structures.

There is a type of prolapse of the uterus occurring in the aged which for constitutional reasons is not suitable for operative work. These individuals can be given relief and go many years longer in comfort if they are properly fitted with a suitable pessary. No pessary for such a condition is as suitable as the "Menge" pessary. It is made in three sizes and consists of a ring with cross bar, in one piece, and knob or handle, in another piece. The ring is first introduced after replacing the uterus

in the pelvis and then the knob is fastened into the ring by a little slot in the cross bar. This knob or rudder keeps the ring in place and does not allow it to turn over and fall out. The good qualities of this pessary are only appreciated after one has used it for some time.

The old belt and stem pessary advised by some to hold up the prolapse is too much "harness" and is very uncomfortable to the patient. It causes a maximum amount of irritation to the cervix and uterus, and I can see no use for it.

In over one hundred interposition operations either uterus or ligaments being interposed, I have had but three recurrences. These I attribute to error in selecting the cases. They were in the earlier part of my career and I did not understand the principles of prolapse of the uterus then as well as now.

411 Wall Building.

DISCUSSION (Abstract)

Dr. H. A. Davidson, Louisville, Ky.—As long as women are delivered naturally we shall have prolapse of the uterus. If we could bring ourselves to the state of mind where we did cesarean section on all women, of course we should not have prolapse of the uterus often. If we could bring ourselves to the state of mind where we did version on all cases and therefore cut down the length of labor, probably we should cut out a good many cases of prolapse of the uterus. We have all seen many women, grandmothers, delivered years ago, naturally, many in the country where the physician was not present, and therefore could not be blamed for what resulted, and many of these women have developed prolapse of the uterus. We have prolapse of the uterus in savage tribes, although these women deliver themselves very easily without any complications. There is no doubt that the length of the labor has much to do with prolapse after delivery.

I wish to speak particularly regarding treatment. I note that Dr. Newell said there was very little use in treating prolapse of the uterus in women who are still bearing children. There are cases of women who have had two or three or four children in the early thirties with severe prolapse. I recall one at the present time, of a complete prolapse. The uterus came down between the legs and the cervix was lacerated bilaterally. This had been going on for four or five years and the woman was a nervous wreck. She had tried to commit suicide. Something must be done in such cases.

We have to do a combined operation, repair the rectocele and cystocele and the lacerated cervix and then go in above and do a suspension of the uterus, preferably by the round ligaments. Many operations have been devised for this condition. In a popular text book which I saw recently there were about thirty-five operations with thirty-five different names attached. Every man who does gynecological work has formed a group of operations in certain classes of cases which he thinks ideal. When the Watkins-Wertheim operation was first described gynecologists all over the world tried it in many cases with both good and bad results. We get our best knowledge of the treatment of prolapse of the uterus in reading carefully the analyses of operations that have been performed over a great many years. I was interested in the one that came out from the Massachusetts General Hospital, where they tried various operations and various groups of operations. Some day some one will come forward with an operation that will give better results than all the previous ones.

If the obstetrician can repair the lacerations at the time of delivery he can prevent many gynecological troubles.

Dr. Barton Cooke Hirst, Philadelphia, Pa.—If two ligaments, the cardinal and the utero-sacral are preserved, the uterus cannot prolapse, and if these two ligaments are injured just as certainly the uterus will prolapse. Any operation which does not take account of this fundamental principle will be more or less unsatisfactory. I have fastened the fundus uteri to the abdominal wall and have subsequently seen the cervix with the inverted vagina protruding from the vulva. I have also done the Watkins-Wertheim operation carefully and have seen the corpus uteri remain in perfect position afterwards, but the vaginal portion of the cervix protrude from the vulva. These failures I am convinced are due to the neglect of repairing the cardinal and the utero-sacral ligaments. Since acting on this principle I have had no trouble.

The cardinal ligaments are strong bundles of fibrous tissue running in the bases of the broad ligaments and circling back to the sacro-iliac junction. They are well illustrated in Wertheim's book on pathologic anatomy, which shows not only dissections but numerous cross sections of the pelvis at different levels. They are also described in Waldeyer's book, "Das Becken." These ligaments were first employed by Alexandroff to tilt the cervix and lower uterine segment upward and backward. It is a little more difficult to deal with the utero-sacral ligaments by the vaginal route. One can, however, display the utero-sacral ligaments through the posterior or anterior vaginal vault, eliminating the necessity of an abdominal operation. On obtaining access to them a suture of linen thread catches them near the middle and crosses them over to the cervical origin of the opposite one in such a way as to make of the two ligaments a St. Andrew's cross, thus shortening each ligament by about two inches. This pulls the lower part of the uterus backward and upward and helps to prevent a recurrence of the prolapse. If, in addition the cardinal ligaments are utilized by the Alexandroff principle I feel confident of a permanent cure of the prolapse of the uterus.

I am not in agreement with the recommendation to utilize the fibrous tissue between the cervix and the bladder. Most of us cut the utero-vesical ligament in operations for cystocele, showing how little importance we attach to it. There is a fundamental fact in prolapsus uteri that appears to be overlooked. These injuries of the birth canal are independent of one another. There can be a prolapse with a rectocele or cystocele, or a cystocele without a rectocele or prolapse. There can be a rectocele without a prolapse or cystocele. How otherwise can we explain prolapse of the uterus in nulliparous women without any possibility of rectocele or cystocele. A contributing factor to cystocele should be borne in mind. I quote Waldeyer in stating that the only support possessed by the lower third of the anterior vaginal wall is the compressor urethrae

muscle. Neglect of injuries to that muscle ignores an essential feature of operations for cystocele. Almost all of the operations for prolapse of the uterus are combination operations on the uterus and anterior and posterior vaginal walls, but we must keep this thought in mind, that the three areas are independent of one another and must receive the separate attention that each demands.

This subject has long been a matter of anxious thought to me. It is only in the last few years that I have had an easy mind about the repair of injuries of the genital tract in general, and particularly in regard to the repair of the ultimate expression of these injuries in prolapsus of the uterus.

Dr. M. Pierce Rucker, Richmond, Va.—A factor in the etiology of this condition is in drug induced labors. Often the patient will have bearing down pains before the uterus starts to dilate. The only case of prolapse of the uterus I have had was in a primipara about 40 years of age, who was toxic and who was given a dose of castor oil. She had strong bearing down pains for several hours that forced the undilated cervix down on the perineum and caused a bulging of the perineum, a very pretty demonstration clinically of what Dr. Hirst has just said of over-stretching of these cardinal ligaments. She developed the prolapse when she went home, though there was no damage to the perineum. That point should be borne in mind when we induce labor in elderly primiparae with drugs, because we may force the uterus down on the perineum and keep it there for hours while the patient has these psuedo-bearing-down pains.

A CASE OF CYST OF THE OMENTUM WITH TWISTED PEDICLE, AND REVIEW OF THE LITERATURE*

By C. S. LAWRENCE, M.D., F.A.C.S.,
Winston-Salem, N. C.

"The literature on the subject of omental cysts is not only scant, but shows a great variety of opinions as to the interpretation of the word "cyst." A perusal of reported cases shows that practically every variety of tumor or growth, in which there was fluid present, has been included under that head. The word "cyst," as it is generally used, particularly with respect to the comparatively few cases that have occurred in the omentum, conveys practically no idea of the character of growth which it is presumed to describe. This is true, in a measure, in the use of the word in general surgical literature, and it would seem that, if we are to use the term "cyst," it should be restricted to mean localized collection of fluid within a limiting membrane without definite reference to the pathology, whereas the term "cystoma" could, and should, be more properly used to characterize actual, new, cystic growths, in which we have secreting cyst spaces, and a definite, constant, neoplastic formation."—Louis Frank.

The statement as to the meagerness of the literature on the subject of cysts of the omentum is as true today as when Dr. Frank published his article eleven years ago. We have, however, found a few recent cases here and there reported.

The first case of true omental cystomata was described by Gairnder, in 1851, and since then 44 cases (including one described by Frank) have been recorded. A careful analysis of these shows that not all are to be classed as true cystomata.

As to the etiology of these tumors, Jacobi believes with Rokitansky that they are of lymphatic origin and the result either of dilatation of the lymph vessels or a cystic degeneration of the lymph nodes.

Frank adds that it is believed by a great many observers that these growths are congenital, and he quotes the statements of another writer that there are three things that stand out in connection with these cases:

"(1) The impossibility of pre-operative diagnosis; (2) greater frequency in children, 50 per cent occurring under the age of 10 and 65 per cent under the age of 20, which leads to the belief that they are of congenital origin; and (3) greater frequency of these growths in the female."

C. N. Davis, in an article on "Cysts of the Omentum," published several years ago, says that these tumors are uncommon and give two main points of interest: (1) Practical, referring to their diagnosis and treatment; (2) academic, referring to their origin. He then says:

"(1) From the practical standpoint we may remember that at rare intervals these cysts are found, that their symptoms in non-malignant cases are mainly mechanical, due to pressure or traction on surrounding structures, and that operations have in the main been successful and free from serious difficulty, about 86 per cent of the reported cases having ended in recovery.

"(2) Origin: The origin in most of the cases has been apparently similar to that of mesenteric cysts: (1) embryonic cysts; (2) cystic malignant disease; (3) echinococcus cysts. Most of the cysts of the omentum may be included in the same classification, for it is evident that embryonic nests may occur between the peritoneal layers of the omentum as they do between those of the mesentery, although such occurrence is less common."

John Speese, Associate in Surgical Pathology in the University of Pennsylvania, writing in 1920 on a case of "Cyst of Omentum With Twisted Pedicle," says that besides the probable embryonic origin, a number of authors believe that all these cysts are lymphatic in origin; but that Hasbrouck believes most of them to be endotheliomata and does not believe that many are congenital.

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*Read in Section on Surgery, Southern Medical Association, Eighteenth Annual Meeting, New Orleans, La., Nov. 24-27, 1924.

According to Stillman, it is significant that the swelling of the abdomen was first noticed at some period between the ages of one and ten, in fifteen of twenty-one cases operated upon, and in ten of these, or nearly half of all cases he collected, the swelling was noticed between one and four years of age. Such facts, he thinks, point to the congenital origin. Of the total of 46 cases of omental cyst formation of all kinds, Stillman found but 22 to be true serous cysts.

Outerbridge, in writing on cysts of the omentum, reaches the conclusion that the lymph vessels are the starting point of true cyst growths in the majority of cases.

Kinney and Mason, Tuskegee Institute, report a case of multilocular cyst of the great omentum in a colored woman, age 30, who had borne eight children. Dr. Jos. C. Bloodgood, of Baltimore, studied this specimen and confirmed the diagnosis. He also added eighteen cases of lesions of the omentum on record in the Surgical Pathology Laboratory of Johns Hopkins Hospital, seven omental cysts, ten chronic inflammatory tumors and one sarcoma.

Dr. K. Kornblum reports a case of echinococcus cyst of the omentum in an Italian man, 28 years old, a carpenter and factory worker, who had never been in intimate contact with dogs. The tumor was noticed four months before operation. At operation the cyst was ruptured, the peritoneal cavity irrigated with a weak solution of iodin, and there was a good recovery.

My own case follows. This is the first omental cyst that I have seen in a fairly busy surgical practice extending over a period of sixteen years.

J. G., age 3, a white female, had a good family history. Her chief complaint was pain in the abdomen. Twenty-four hours previously she was taken with severe pain in the abdomen, screamed and was very restless. She had complained frequently during the preceding six months of pain in the abdomen which was promptly relieved by a laxative. She had not vomited during any of her attacks, nor had she vomited during the one in which I saw her. The bowels had not moved since she became ill 24 hours previously, although the mother and family physician had given one dose of calomel and one dose of oil, followed by three enemas.

Past History.—She was born at full term, by forceps delivery, and had always been a healthy child, breast fed. She had whooping cough at the age of 2½ years, with a good recovery, and no other illness. The mother had noticed her large abdomen all the child's life, and neighbors and friends had also called attention to the condition. The appetite had always been good. She slept well and there had never been any trouble referable to the kidney.

Physical Examination.—Her pulse was 120, and respiration 30. She was a well nourished child in great distress. The abdomen was much distended and fixed, and the respirations hurried and shallow. The distention of the abdomen was symmetrical and the superficial veins were much distended and visible all over the abdomen. On palpation the abdomen was tense, smooth and quite tender, dull on percussion, and there was cyanosis. Otherwise the child was well proportioned.

Laboratory Findings.—The urine was acid, its specific gravity 1035. There was no albumin or sugar, but pus 1, scale 4. She had 12,000 white blood cells, 82 per cent of which were polynuclear. She was operated upon June 12, 1924. The abdomen was very markedly distended, and upon opening it a large cyst was seen. A portion of this was delivered packed off, tapped and 2,000 c.c. of dark fluid were removed. A large piece of necrotic tissue floated out with the fluid. The tumor was an omental cyst attached to the transverse colon. The pedicle had become twisted on itself with three turns. The cyst filled the entire abdomen and pelvis, bulging the flanks and making pressure on the diaphragm. The cyst was removed by clamping the pedicle, cutting and ligating with number 1 chromic catgut. There were no adhesions. The abdomen was closed in layers without a drain.

June 22, all stitches were removed. There was a slight skin infection. Otherwise, the condition was good. June 24, she was discharged from the hospital. The wound had healed, the abdomen was flat, the appetite good, and she slept well. June 30, 1924, she was well and healthy.

Pathological Description.—The specimen consists of an irregular shaped thin walled sac with several large communicating compartments. The total capacity is estimated as 1,000 c.c. In the walls are a few small patches of fat and occasional small vessels and slender fibrous strands, with occasional small nodule from 1 to 3 millimeters in diameter. There is also a loose spongy mass (6x3x3 centimeters) which resembles a mass of omentum, squeezed and wadded together.

Microscopically, the wall of the sac is a delicate connective tissue membrane, lined in part with low flat cells, resembling endothelium, and in part a layer of fibrin. The little nodules in the wall consist of a delicate connective tissue mesh filled with lymphoid cells and endothelia cells. The separate spongy mass consists of a loose reticulum of fibrin containing many lymphocytes and endothelia leucocytes.

The treatment of omental cysts is, of course, operative, and consists in simple removal of single cysts, or as much of the omentum as may be necessary when multiple cysts involve this structure. While tapping has been mentioned frequently in many of the older case reports, it is doubtful if this is justifiable at present, as operative interference has given uniformly good results.

The great omentum consists originally of four layers of peritoneum which, during the course of development, become fused into two and include a cavity which is a part of the bursa omentalis (Sabatta-McMurrich). It would seem reasonable to suppose that inflammation of the peritoneum, especially of the lesser cavity, would

be a decided factor in the etiology of cysts of the omentum. The early colics of babies are no doubt frequently due to such pathologic processes. We do know that infants suffer with cholecystitis, appendicitis, diverticulitis, and for that matter, any of the organs in infancy and early childhood may be attacked by pathogenic organisms just as in later life. Inflammatory fluid encysted between the folds of the omentum may lie quiescent for months or even years, as we have seen in hydrosalpinx, the result of salpingitis. By some accident, such as the cyst's becoming inflamed or twisted at its attachment, a crisis is produced. In the case here reported the pathologist stated that the condition was most probably the result of an inflammatory process closing the lymphatics that normally drained the omentum.

I wish to express my sincere thanks to Dr. Joseph C. Bloodgood, of Baltimore, for his review of material on this subject, and for the loan of lantern slides. I also wish to thank Dr. James B. Bullitt, Professor of Pathology, of the University of North Carolina, for his study and report on the specimen of the case here reported.

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Lawrence Clinic.

DISCUSSION (Abstract)

Dr. Everard A. Wilcox, Augusta, Ga.—This may, of course, be a multilocular lymphatic cystoma, which sometimes appears in the peritoneum, though the subject as developed leads rather toward the idea of inflammatory origin. The presence of the endothelium lining the cavities may be incidental, from the normal covering of the omentum, or from the lymphatic vessels within the omentum. The omentum easily surrounds inflammatory foci, and it is not extraordinary for it to become the seat of secondary abscess, as I myself have seen. We may conjecture that in the process of resolution of an omental abscess, fluid may remain encapsulated, become inspissated, and transudation into it may later occur; it may sufficiently irritate its environs so that a capsule develops, and in time the dilatation of lymph channels, interference with circulation, etc., may lead to such multilocular cyst-formation as Dr. Lawrence has shown.

I gather from the paper that this is an inflammatory or exudation cyst, and not a cystoma.

EYE, EAR, NOSE AND THROAT

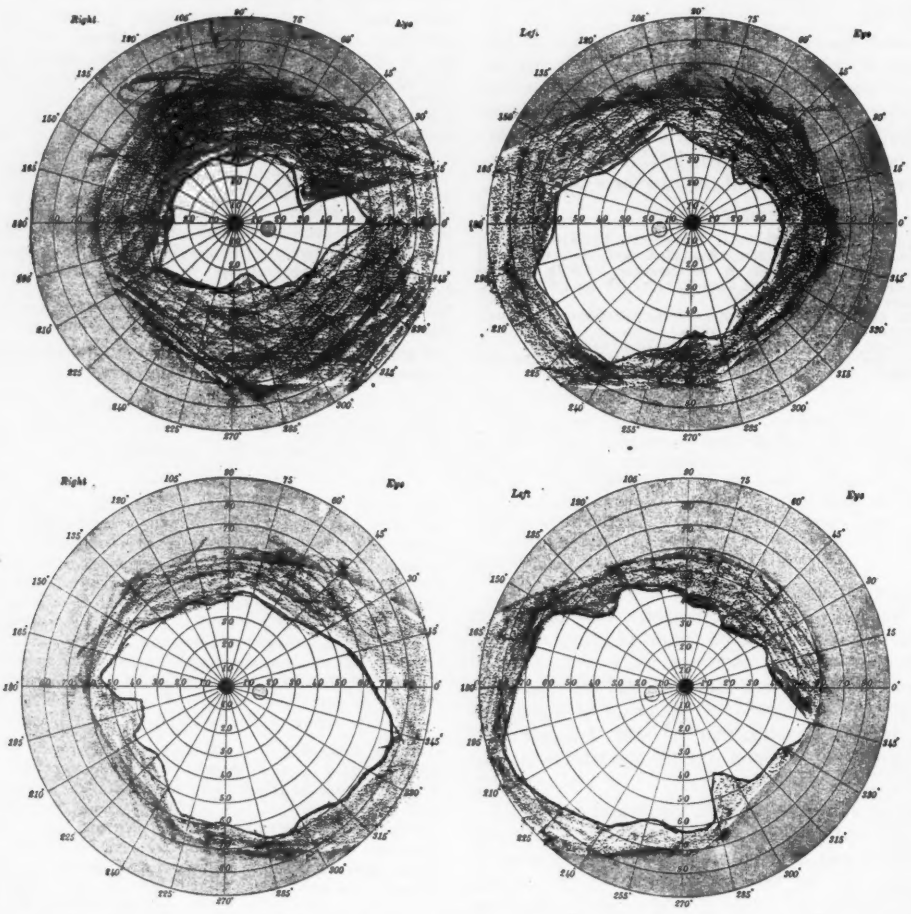
THE VISUAL FIELD IN TOXIC UVEITIS*

By H. H. MARTIN, M.D.,
Savannah, Ga.

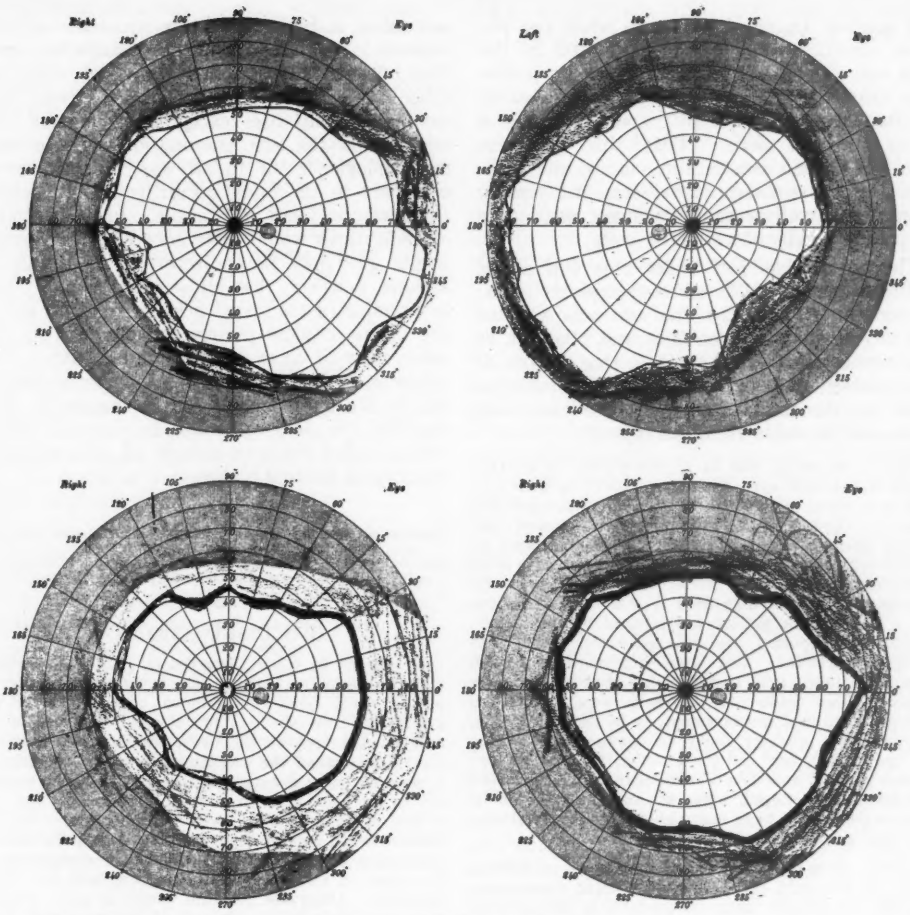
The ocular syndrome described in this paper as toxic uveitis is, I believe, a very common one, though it is not always recognized until after serious and often permanent pathologic changes have been established. With the exception of two cases reported by the author before this Section at the Asheville meeting in 1919, I do not find mention of it in any of the ophthalmic literature at my disposal.

The clinical symptoms in the early stage are quite mild in character, the patient complaining only of occasional floating bodies with some confusion of vision and I am convinced he is often turned away with the assurance that the floating bodies are physiological and that a laxative is the only treatment indicated. A more

*Read in Section on Eye, Ear, Nose and Throat, Southern Medical Association, Eighteenth Annual Meeting, New Orleans, La., Nov. 24-27, 1924.

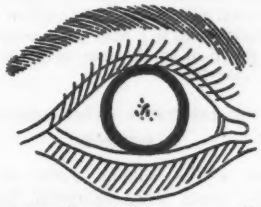


Top Left and Top Right. Case No. 1. First Examination.
Bottom Left and Bottom Right. Case No. 1. One week after extraction of infected tooth.



Top Left. Case No. 1. Three weeks after extraction of infected tooth.
Top Right. Case No. 1. Three weeks after extraction of infected tooth.
Bottom Left. Case No. 2. First Examination.
Bottom Right. Case No. 2. Four days after extraction of two infected teeth.

careful examination however, will often disclose a definite pathology consisting of a slight cloudiness of the anterior segment of the vitreous with usually one tadpole shaped floating body surrounded by numerous granular and occasionally some string-like bodies, visible to the observer only with a plus ten to plus twenty lens. The fundus appears normal in every respect and in the early stages the exudates are definitely limited to the anterior segment of the vitreous. The interesting feature in this group of symptoms is the contraction of the visual field for white, without any alteration in the color fields and without visible or demonstrable pathology of the optic nerve, and, as will be shown in the lantern slides, in at least one case the contraction of the visual field was present



A typical group of exudates as seen with plus 20 lens in Case No. 2.

to a marked degree in both eyes while the vitreous opacities could be demonstrated in the right eye only, the left eye showing no pathologic changes. The symptoms all disappeared simultaneously and promptly upon the removal of an infected tooth. That this syndrome should be classed as a definite clinical and pathologic entity seems quite evident, and equally definite and convincing is its direct relation to a septic focus elsewhere in the body.

The author has had under observation and treatment since 1919, sixteen typical cases; fourteen in which only one eye was affected and two in which the condition was bilateral. In this connection I must confess that in ten of the fourteen unilateral cases the field was not taken in the unaffected eye. The two cases shown on the slides are quite typical.

Case 1.—A young man of 25, complained of floating bodies in the right eye. Vision was 20/20 in each eye, both eyes being hyperopic: right, 2 dioptre; left 1½ dioptre. Ophthalmoscopic examination revealed the typical group of exudates in the anterior segment of the vitreous of the right eye. There were no visible pathologic changes in the left eye. The field for white was sharply contracted in both eyes as shown in slides No. 1 and 4. The patient was referred to a roentgenologist who reported one infected tooth which was promptly extracted. One week afterward the fields were again taken with improvement as shown in slides 2 and 5. Two weeks later, the fields were again taken showing continued improvement as in slides 3 and 6. No pathologic changes could be demonstrated in the left eye at any time and the exudates in the right eye cleared rapidly and finally disappeared, which would indicate that the optic nerve disorder, whether it be toxic or pathologic, is an essential part of this syndrome and may even precede the uveitis.

Case 2.—A man of middle age complained of floating bodies in the right eye. Ophthalmoscopic examination revealed the typical group of exudates in the anterior segment of right vitreous with no other visible pathology. The left was apparently normal. In the right, vision was 20/50, left 20/20. There was no error of refraction, and the field for white was sharply contracted as shown in slide No. 7. The field was not taken in the left eye. Radiographs showed two infected teeth which were promptly removed. Four days later the field was taken in the right eye with an enlarged field as shown in slide No. 8 and vision was 20/30. Vitreous exudates did not appear in the left eye at all and those in the right eye rapidly disappeared, field and central vision being restored to normal in six weeks. On slide No. 9 I have endeavored to illustrate the typical group of exudates as seen with the ophthalmoscope in case No. 2.

SUMMARY OF EIGHTEEN CASES OBSERVED BY THE AUTHOR

All were adults, eleven male, seven female. Two of the cases were bilateral, pathologically and clinically and in all cases where the field was taken in both eyes, there was more or less concentric contraction in the unaffected eye. Two relapsed but promptly recovered when the cause was located and removed. Recovery was complete in all cases except one, who did not return after the first examination. The principal etiologic factor in all was a septic focus elsewhere in the body occurring about equally frequently in teeth and tonsils. Just how many of these cases would have gone on to a general uveitis can only be conjectured. It is fair to assume, however, that all of them would. The contraction of the visual field, so constant a factor in the clinical picture, should lead to the uncovering of more of these cases, with a curtailment in the number of cases of graver pathology in the uveal tract. May I suggest in closing that the field for white be carefully taken and recorded for both eyes in all patients complaining of floating bodies.

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DISCUSSION (Abstract)

Dr. Henry N. Blum, New Orleans, La.—The striking thing to me in Dr. Martin's case is the rapid restoration of the visual fields after removal of the cause of the condition. How much of this restoration is due to the cure of pathology in the uvea, and how much is due to the removal of the exciting cause of the condition is a question to be debated. If there were enough pathology in the uveal tract to produce vitreous opacities, and if this pathology in the uvea were responsible for the narrow fields, several days would be too quick for the restoration of these fields. I believe the explanation to lie rather in the fact that the narrow field is a reflex condition. Otherwise the cure would be more gradual. A striking fact is the absence of the narrowed fields for color, particularly blue, which is usually very susceptible to change in diseases of the uvea.

Dr. K. W. Constantine, Birmingham, Ala.—I want to congratulate Dr. Martin upon taking the time and trouble to take the field of vision in these cases of marked uveitis. My only criticism is that the fields in the normal eye were not taken as well. It seems that we are all afraid to take the normal field of vision. Although the perimeter is recognized as a diagnostic aid second only to the ophthalmoscope, we usually make the diagnosis and expect to find a certain kind of field before we use the perimeter, which I think is a mistake. When we take the field of vision we usually have the office assistant do it. After this paper of Dr. Martin's I am sure there will be a number of us who will take the fields of vision in these cases who would not have done so before.

In regard to the etiology of these cases I believe we all agree that abscessed teeth and tonsils are the principal causes, but we should not overlook a number of other possible causes. I have one patient who told

me she could cause these opacities by eating meat. I have seen cases reported similar to that where, by leaving off meat entirely they could get rid of these opacities. I have a man under observation who had a definite uveitis in one eye. We removed an abscessed tooth and he seemed to improve very much but later had a relapse and also showed the same trouble in the other eye. We then discovered that he had a chronic bronchiectasis which is being treated with vaccine. It seems to me that the vaccine treatment in a number of these cases is going to be of some benefit.

Dr. J. A. Stucky, Lexington, Ky.—I have had a number of cases complaining of occasional floating specks and until a year or two ago have considered them cases of acidosis or intestinal toxemia, chiefly for the reason that the trouble yielded to hyperalkalinization of the secretions. I have continued the alkali treatment for several weeks or months with a restricted diet as to animal proteins, pastries and sweets, with very good results. I have never thought the floating particles were the result of a definite pathology, nor did it ever occur to me to take the visual field, or that trouble with the fundus or a refractive error would account for the condition.

In the last two or three years I have had several cases which did not yield to the treatment referred to and in two of them removal of the tonsils gave relief, while in three others extraction of teeth with apical abscesses gave the desired result. I recall several years ago, a case of this kind, who lived about a hundred miles from me, and who returned in a few weeks with a uveitis in both eyes, with loss of vision. In this case I had not had a roentgenogram of the teeth made, nor did I have any record of focal infection in the tonsil, teeth or sinuses. There was a low grade of nephritis and the urine contained four-plus indican.

The cases described will have a new interest for me in the future and I shall make a note of the visual field for white, as noted by the essayist, and shall report the results of my observations.

Dr. Martin (closing).—I did not intend to give the impression that the exudates cleared up with the same rapidity that the field of vision did. The fields of vision invariably showed improvement following removal of suspected foci, but the vitreous exudates require weeks and often months for their final disappearance.

One of the cases shown on the slides in which the exudates were only faintly visible, and the fields moderately contracted, cleared up entirely in six weeks.

Answering Dr. Moore's question as to whether there was enlargement of the blind spots, I do not know. The scotometer was not used in any of these cases.

I do not know whether I am presenting simple uveitis in the incipient stage or whether we have a hitherto unrecognized syndrome. But certainly no patient should be assured that floating spots are physiological until after the visual field has been charted and the anterior segment of the vitreous carefully searched with a plus ten to twenty lens for minute exudates.

EYE INJURIES AND DETERMINATION OF THE AMOUNT OF THEIR PERMANENT DISABILITY*

By WILLIAM LAPAT, M.D.,
Houston, Tex.

The question of industrial injury is an important one. It always intimately concerns four individuals: the patient, the doctor, the employer, and the insurance company.

The first compensation act was passed in 1897 by England. The United States passed its first act in 1911, and since that time most of the states have passed these laws. Each state has its own method of administration. Some have industrial boards or commissions; some have a single commissioner; and some have the courts administer it. The payment of compensation in some cases is by the insurance companies and in others by the state.

It is of the utmost importance that the surgeon should be intimately acquainted with the act of his own state, and especially with that part of the act which concerns his own specialty.

Texas has an industrial board. The compensation is paid by the insurance company which has insured the employer. The rate of insurance is raised or lowered from year to year depending upon the number and type of accidents in each company. The compensation comes under three classes: death, total disability, and partial disability. As this paper is concerned only with eye injuries, we shall deal only with total and partial disability. The total loss of vision of one eye entitles the patient to 60 per cent of his weekly wage for 100 weeks. This 60 per cent shall not be less than $7.00, and not more than $20.00 a week. Any injury which incapacitates him for any time longer than eight days must be paid at the rate of 60 per cent of his weekly wage.

It can be easily seen that all are deeply concerned in this act. The doctor, however, has the most important duty. Upon him rests the greatest responsibility. It is he who decides whether or not the condition is due to an injury. It is he who orders the patient back to his duties; it is he who reckons the amount of permanent disability.

The reckoning of the amount of permanent disability, in some cases, is very difficult. There

*Read by title in Section on Eye, Ear, Nose and Throat, Southern Medical Association, Eighteenth Annual Meeting, New Orleans, La., Nov. 24-27, 1924.

are many things to be considered. If a man receives an accident severe enough to cause total loss of vision of one eye, he naturally has 100 per cent permanent disability of that eye. That is simple enough. However, in most instances, the loss of vision is only partial, and he must receive compensation commensurate with the percentage of loss.

The Chicago Ophthalmological Society has endorsed Dr. Frank Allport's table by which he computes the percentage of loss of vision. By this table a vision of 20/20 is considered normal; 20/30, a 5 per cent loss; 20/40, 11 per cent loss; 20/50, a 16.5 per cent loss, etc. Allport has figured out just how much loss of function these various visions represent. The table is a very excellent one, but one cannot be guided entirely by it. Any man may be given his percentage of loss and the patient may find that a year later, after the case has been closed, his vision has become much worse. There may also be in addition to the loss of vision some injury to the structures around the eye. As an example of this I have the following case:

Case I.—G. F., a male, age 30, was struck on the right upper lid by a wrench. He had a small corneal ulcer with slight ptosis of the upper lid. When the patient was discharged it was found that he had a vision of 20/30 with a slight ptosis.

According to his vision, he would receive only 5.5 per cent disability.

In a case of this kind the man should not be discharged until one is reasonably certain that the ptosis will either remain stationary or clear up.

There are other factors that must be considered. A man's employment should figure in the amount of disability. A laborer who has been injured so that he has a 50 per cent loss of vision is certainly not incapacitated as much as an individual whose work necessitates the closer application of his eyes.

One must also consider the question of vision before injury. An employe who has a vision of 20/70 before injury and has 20/200 after it, should not be entitled to the same amount of disability as one who had normal vision.

It requires judgment to be just in reckoning the amount of permanent disability. The handling of industrial eye cases teaches an oculist a number of things. There are four which are learned early in one's experience:

(1) It is surprising with what frequency and placidity an employe will present himself, claiming an injury, when examination reveals no injury whatsoever.

(2) Invariably the injured employe will claim a much higher loss of vision than he really has.

(3) The most severe eye symptoms will be blamed upon the most trivial injuries.

(4) Employes may claim blindness after injury, when in reality the eye was blind before injury.

In order to make myself more clear I will recite a few cases giving only the salient features.

I have had employes present themselves with the story of having had a foreign body a day or two previously. Upon examination there will be found chalazions, styes and many other kinds of eye conditions which could certainly not have been caused by the foreign body. A most flagrant case of this type I saw recently.

W. E. McL., a male, age 49, was injured August 23, 1924, while shearing mules. Something got into his left eye. This was treated by two different physicians for a period of thirty days, after which he was sent to me for examination and report of the amount of disability.

On examination it was found that there was a complete left-sided facial paralysis, with its usual marked ptosis of the left lower lid, a vision in the right eye of 20/70 and in the left eye of 20/30. With correction both eyes had normal vision. He also had a well developed Rhomberg. There was no evidence present of the foreign body accident. A foreign body certainly could not have caused the conditions found.

THE EXAGGERATION OF THE AMOUNT OF LOSS OF VISION

This class is a large one. Going over 933 cases of the past eighteen months it was found that 60 per cent claimed loss of vision due to injury. The ordinary vision test was always followed by a malingering test (usually with cylinders) which showed that only 15 per cent had any real loss of vision and in some of these cases the loss was due to an error of refraction.

SEVERE SYMPTOMS CLAIMED ON TRIVIAL INJURIES

It was found that employes would return in two or three weeks after a minor injury with the statement: "Ever since I had that 'thing' in my eye, my eyes have been aching and blurring so that I cannot see well." If they happen to be at the presbyopic age they will usually add that before the injury they had no trouble in reading, but that now the letters all run together.

W. E. H., a male, age 40, stated that while looking at some electric welding on August 29, 1924, his eyes began to burn. Examination showed a slight conjunctivitis. Vision was 20/20 in each eye. He was discharged after one treatment and was told if his eyes gave any more trouble to return the next day.

He returned a month later complaining that since his injury he had been unable to go to picture shows or to read for any length of time. Complete examination revealed nothing except an error of refraction of plus 1.75 in each eye. It was impossible to make him understand that this error was not due to his injury.

BLINDNESS CLAIMED AFTER INJURY WHICH WAS PRESENT BEFORE INJURY

H. C. C., a male, age 30, sustained a fractured skull May 9, 1923.

His chief complaint was that the left eye had been blind since injury. I saw him four months after the injury, at which time his only complaint was blindness of the left eye. He was sent for an opinion as to the cause of the loss of vision. Examination revealed that the right eye had three diopters of hypermatropic astigmatism. Vision of the right eye was brought to 20/20 with correction. The left eye could not be improved. This was purely and simply a case of amblyopia exanopsia as all other conditions, except the error of refraction, were negative. As far as his eyes were concerned he was not entitled to any disability.

This man may not have been aware of the fact that his left eye was blind before his injury.

M. J. H., age 26, injured the left eye January 28, 1924, when he was struck with a wrench. He was treated by two physicians for three weeks and was sent to me for an opinion of the amount of permanent disability. He had been given 50 per cent, but was not satisfied. His chief complaint was blindness of the left eye.

My examination showed the right eye normal with a vision of 20/20. The left eye vision was 20/200. There were some floating opacities in the vitreous and a myopia of 15 diopters. It was my opinion that the myopia antedated the injury and I advised that someone else be asked to see him. He was sent to Dr. Ralston, of Houston, and it was found that a year previous to this injury he had been examined at the Doctor's office because of this blindness. Here was a case that certainly knew the injury did not cause his loss of vision.

There is a great deal of difference in the attitude of private and industrial cases. On the one hand, the patient is only anxious to get well, and on the other, he wishes usually more compensation than that to which he is entitled.

It is scarcely possible to talk about industrial cases without mentioning the question of medical fees. The Texas act distinctly says the fee shall not be larger than a fee that the injured would pay were he a private case. That seems reasonable enough. In private practice we have one of two recourses. We examine our patient for a fee that he can afford to pay, or we send him to some one who will. The industrial cases should be handled in the same way. Smallness of fee should certainly be no excuse for careless work.

The conclusions that I have come to are as follows:

(1) Employers should, both for economic reasons and for the employes' safety, have a physical examination made before putting a man to work. As far as the vision is concerned, a Snallen's test card is all that is necessary.

(2) The doctor should refuse to handle a case as an injury when he is certain it is not one. The patient should, however, always receive the benefit of the doubt in border-line cases.

(3) The doctor should realize his responsibility. In doing so, he will be meticulously careful in examining the case. It is foolhardy, however, to cover an uninjured eye and ask the patient to read out of his injured eye, and then base the percentage of loss of vision on that test. One might as well ask the patient how much compensation he wants.

There can be no exact rule of reckoning the amount of disability. One must go over every phase of the case, be lenient where leniency is due, and stringent where stringency is necessary.

TROPICAL DISEASES AND PUBLIC HEALTH

SYMPOSIUM ON MALARIA

THE MALARIA PROBLEM IN THE SOUTH*

By JOHN A. FERRELL, M.D.,
International Health Board
New York, N. Y.

The National Malaria Committee has met annually since 1916. Its purpose is to afford those directly or indirectly interested in malaria control an opportunity for discussing the problems involved. It brings together field investigators, field workers who are actually applying the control measures, and those interested from humanitarian or economic standpoints. By having reports, observations, experiences, progress, and plans presented and discussed, it is expected that the control measures will be more scientifically, economically and quickly applied. The sub-committees have been formed this year as far as practicable of men actually engaged in investigating or controlling the disease. They should be able, it was thought, to devote more time than others could to committee work. The reports and discussions of others, however, particularly those who have previously served on the sub-committees, have been most valuable. It is hoped that all who can, whether on the sub-committees or not, will participate in the deliberations and thus promote the aims of the National Malaria Committee.

The country's present malaria problem, as reflected by mortality statistics, was admirably set forth for states and counties by Doctor Maxcy at the 1922 meeting of the Committee, and published in the Public Health report of May 25, 1923. He shows that in 1921 and the two years immediately preceding, 520 counties in 16 states, (29 in Alabama, 52 in Arkansas, 4 in California, 41 in Florida, 70 in Georgia, 9 in Illinois, 6 in Kentucky, 55 in Louisiana, 74 in Mississippi, 11 in Missouri, 26 in North Carolina, 20 in Oklahoma, 26 in South Carolina, 27 in Tennessee, 64 in Texas, and 6 in West Virginia) reported a mortality rate of more than one death per 10,000 inhabitants. The percentage of counties in the respective states having a significant malaria problem varied from 5 per cent in Kentucky to 90 per cent in Mississippi, and the proportion of the state's population included in such counties ranged from 1 per cent in California to 92 per cent in Mississippi. In Arkansas, Florida, Louisiana, and Mississippi, approximately three-fourths of the population live in counties having a significant amount of malaria. In a few counties of Arkansas and Florida the rate was 15 per cent per 10,000, and in three or four of them it exceeded this rate. In five states (California 1 per cent, Illinois 3 per cent, Kentucky 5 per cent, Missouri 6 per cent, and Virginia 3 per cent) the malarious counties include only 6 per cent or less of the total population. The figures quoted from Doctor Maxcy's article reveal that in each state the malaria usually is localized. Within the counties, moreover, the disease is not uniformly distributed, but generally is focal in character.

The distribution, incidence, and severity of malaria throughout the country have steadily declined since the Civil War. The death statistics for the New England states and cities showed in 1890 and 1900 a fairly heavy toll from malaria. The mortality statistics for New York City in 1881 showed a death rate of 4.2 per 10,000 from malaria,[1] and the rate did not fall below 1 per 10,000 until 1890. The state of New Jersey, in 1879, had a rate of 2.6 per 10,000 which did not drop below 1 per 10,000 until 1898. Indiana had a rate exceeding 1.4 per 10,000 prior to 1900. The disease is no longer considered of any public health significance in these areas. Similarly, it has gradually receded over an extensive area, including the Middle Atlantic and Middle Western states, so that now only 16 states contain counties in which the disease may be regarded as of public health importance.

A number of factors have probably contributed to the result, but the factor of greatest importance has been drainage for the purpose of reclaiming lands for agricultural purposes. The relative importance of this and other operating factors has not been definitely determined. However, it is reasonably certain they are at work in many of the 520 malarious counties which Doctor Maxcy enumerates.

Such forces as may have been operating against malaria in the South have been systematically stimulated during the past ten years by public health agencies:

(1) Studies have been made of the prevalence, distribution, and characteristics of the disease; of the habits and relative importance of the three prevailing species of anopheles mosquitoes; of methods for diagnosing and economically measuring the amount of malaria in a given community; of the efficacy and public health value of different plans for the cure of the disease; and the economic feasibility, under the varying conditions encountered, of applying individually and collectively many of the methods of control that have been advocated.

(2) The educational work with regard to the disease by the federal, state and local agencies, has been ex-

*Chairman's Address, National Malaria Committee (Conference on Malaria), meeting conjointly with Southern Medical Association, Eighteenth Annual Meeting, New Orleans, La., Nov. 24-27, 1924.

1. There are certain physicians who believe many of the deaths in New York City reported in 1881 as due to malaria were really due to typhoid fever.

tensive. Literature and other educational material have been distributed and children have been taught in many schools the elementary facts regarding the disease. Physicians, teachers, editors, farmers, and local organizations have shared in this phase of the work.

(3) Practical demonstrations of control measures have been made. The towns rather than the rural areas afforded the most favorable fields for obtaining satisfactory results. They are compact in area, in population, and in wealth, and the drainage problems are often minor in character. After proving the feasibility of controlling malaria by drainage and other anti-larval measures a few malarious towns at a cost within easy reach of the people, and after showing that the procedures were practicable for most of the towns having a high incidence of the disease, this type of work was taken up on a large scale during 1920, 1921, and 1922, by the state and local health authorities of 12 states with considerable cooperation, in personnel and funds, by the Public Health Service and the International Health Board. During this period 90 towns, representing approximately 300,000 inhabitants, were protected against malaria. The outside agencies feeling that this phase of the work had been adequately demonstrated, left its maintenance and extension to the state and town health authorities and turned their support to the larger and more difficult malaria problem, namely, the control of the disease in rural communities.

The rural malaria problem of the South has engaged, and is now engaging, the attention of the public health forces. It is the basis for most of the reports and discussions that will be presented at this and other malaria conferences to be held in New Orleans this week. The procedures which succeeded in the towns could be applied equally well in the rural districts if they were economically practicable. The difficulty is largely economic. The relationship in the towns between population and area does not of course prevail in the rural districts. The situation calls for more exact knowledge along all the lines covered by previous investigations, and for additional discoveries; and for organizing, training and maintaining suitable personnel to apply effective measures of control on a county basis with maximum directness. The task is exceedingly difficult, but undoubtedly is progressing toward accomplishment. The problem in the South is much less difficult, however, than that found in the tropics where malaria-bearing mosquitoes breed twelve months in the year, the per capita area to be controlled is extensive, and the per capita wealth is low. The sub-committee reports and the round table discussions you will hear today will dwell upon various recent activities, mainly in the South, reflecting progress.

The rural areas of the South having an important public health problem in malaria, are found in the coastal plains of all seacoast states from Mexico to and including Virginia. The areas of high incidence extend further inland in the Gulf-coast states than in the Atlantic-coast states; they are found along river basins, especially the Mississippi and its tributaries where portions of the inland states of Arkansas, Oklahoma, Tennessee, Missouri, Illinois and Kentucky are included.

The inhabitants are engaged in agriculture mainly. In many of the counties 50 per cent or more of the people are negroes. The climate is mild. The average rural house is loosely constructed and is not easy to screen against mosquitoes. However, a considerable percentage of the farm homes, mainly those occupied by white families, are well-constructed and many of them are screened. Even though screening as a method of control presents difficulties, it is useful and in many localities is affording a considerable degree of protection. The various characteristics of the malarious areas under consideration are probably so well-known by all who are present that a fuller description here is not warranted.

The county is the only political unit which can maintain public health machinery to combat malaria and other diseases in the rural communities. Experience in approximately 275 counties of 30 states, shows that systematic educational effort will lead to an expenditure of fifty cents per capita for health purposes and that it will be continued and often increased if the personnel employed is reasonably efficient. In some counties less than fifty cents per capita is spent by the county for the county health organization whereas in a few exceptional instances the amount has been as much as one dollar.

In the usual county of 20,000 inhabitants, on the per capita basis of fifty cents, $10,000 yearly will be available for the county health organization, an amount sufficient to pay the salary and traveling expenses of a health officer, a public health nurse, a sanitary inspector, and salary of an office clerk. When we think of three field workers serving an area thirty to forty miles square, which has the usual health problems in addition to the one presented by malaria, it becomes obvious that if headway is to be made, the rifle and not the shotgun method of attack must be employed. Malaria must be fought only where it actually exists. Its distribution generally being focal in character, control efforts should be concentrated on the foci. As the size of the spleen in children seems to afford the most dependable and the most inexpensive index to the incidence and severity of the disease, the health officers should master and employ the technic as a basis for determining the amount of malaria in a given area. As the *Anopheles quadrimaculatus* is found to be the only mosquito transmitting the disease under natural conditions, the fight should be centered upon this species. All along the line the fight should be characterized by thoroughness and accurateness in defining the problem and by the employment of only those measures which will yield a large reduction of malaria for the money and energy expended.

These principles, to a varying degree, have been introduced in about 40 county health organizations which are now featuring the control of malaria (26 of which the I. H. Board is aiding financially). The experience

has brought us to a point where there is general agreement as to the essential features which should be embodied in a malaria program for the use of a county health organization. As a plan for the county is listed for discussion at both malaria conferences being held here this week, I shall not take it up except to say that I have seen five separate plans for the county. Three of them I submitted for comments to about thirty health officers, and received comments from fifteen. All the plans and comments were in general accord as to essential features such as relationship of the state and county organizations, the personnel required by each, the malaria survey, the mosquito survey, and the protective measures. Some difference of opinion which I think was more apparent than real related to the amount of laboratory and technical work the county organization should undertake, and to the sources from which funds should be derived to meet the cost of drainage and other anti-larval measures. These points will I hope be reconciled this week and a county plan adopted which will be acceptable to all the states. If this hope is realized and an acceptable plan can be formulated for obtaining and adequately training the personnel required, I believe that rural malaria in spite of the difficulties it presents will yield with increasing rapidity to the forces at our command. It may be that there are areas which will not come under control until they are more densely populated and land values rise, and a much more expensive program than now seems economically feasible can be instituted. Even the day when the economic situation will permit undertaking control measures far beyond our means at present may not be very far removed. The developments in Maryland, New Jersey, and other Northern states, as well as those which have occurred in the South during the past twenty-five years, should give encouragement.

SOME REMARKS ON THE MALARIA OF THE DUTCH EAST INDIES*

By E. W. WALCH,
Amsterdam, Holland

I consider it a great honor to speak of the malaria in the Dutch East Indies before your meeting, but I must confess that it would be perhaps easier for me, though certainly of very little interest to you, to say something about the malaria in the South of the United States, as the great hospitality that I encountered everywhere when I was traveling there last summer enabled me to get an extremely valuable insight into your work.

Rather than to enter into details about the distribution of the malaria and its particular aspect in the several parts of the Malay Archipelago I should like to point out some of our problems in general, and our way of examining them. In doing so I shall have to speak chiefly about investigations done in our colonies. I think it superfluous to emphasize how fully aware we are of the important work done by others.

Generally speaking, malaria still remains a greater problem with us than hookworm disease. In the case of the latter disease we know approximately at least, how to fight it. In the case of the former the period of investigations and research is much farther from being closed. One thing seems certain, that is, that the eradication will require enormous financial resources. The policy of our medical service therefore at the present time is to assemble as much data as possible in order to find out the most economical way of preventing and eliminating the disease.

There occur in the Dutch East Indies, which according to one of our poets "lie as a belt of emerald along the equator," somewhat more than 20 species of anophelines, of which only 3 or 4 nowadays are considered as carriers of importance. It is scarcely necessary to recall that after the years during which the medical men did not pay much attention to the existence of different species of anopheles, there came a period in which due largely to the work in the Far East, of Stephens and Christophers, Watson, Walker and Barber, Stanton, and in our colonies Swellengrebel and Schuffner, it was clearly recognized that certain species were much more dangerous than others. This often enabled the health officer to concentrate his activities against one species only. In the case of our most feared carrier, the M. ludlowi, this species had more or less localized breeding places and this was a very lucky fact. As time proceeded and still more epidemics were studied, it appeared, however, that the number of carriers in nature was greater than was first thought, and the interesting fact was disclosed, that certain species, which were considered as practically harmless, under certain circumstances difficult to define, could be responsible for epidemics. Among those the M. sinensis and the C. kochi might be mentioned. This question is closely related to the fact that certain species which are important carriers in the Federated Malay States, just across the Strait of Malacca, in Sumatra, until now have been of little practical importance, for example the M. umbrosus.

These facts are difficult to explain. Let us consider the sinensis. Especially in respect to the subtertian fever until recently it was discarded as a carrier though experimentally it had been infected as high as 50 per cent (average 4 per cent) with this form of malaria by Swellengrebel and Schuffner.[1]

The first chart, however, (Fig. 1) will show you an epidemic occurring among 800 coolies in a coconut plantation near the sea, consisting of a good many cases of subtertian, that was chiefly occasioned by this anopheline. (In this map is reproduced in the bottom diagram the parasite and spleen indices of the adult population and in the two upper diagrams is shown the

*Read before the National Malaria Committee (Conference on Malaria), Meeting conjointly with Southern Medical Association, Eighteenth Annual meeting, New Orleans, La., Nov. 24-27, 1924.

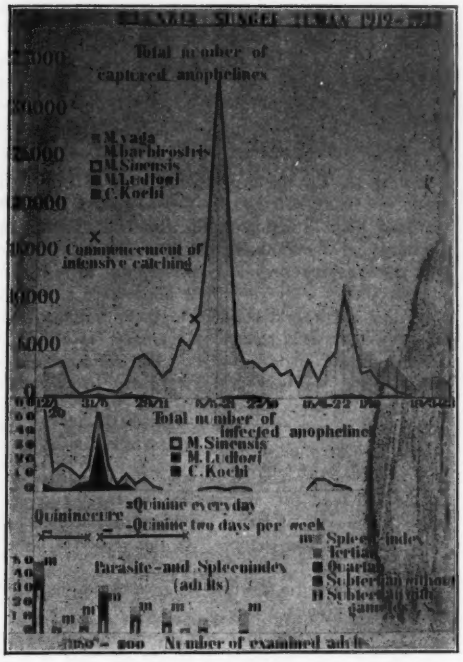

Fig. 1.

number of anopheles captured every four weeks and the result of their dissection.)

Can we find any reason for this variability in behaviour? Is it due perhaps to a variation of the feeding habits of the anopheles? Will the sinensis as a rule attack especially animals and will it only occasionally prefer human beings? In the beginning it seemed as if the latter might have occurred here. We had placed 3 buffaloes, each in a small closed stable, provided with mosquito traps instead of windows, round one group of dwellings and only few sinensis were caught in the stables (4000 against 135,000 in the coolie lines). But later when some 15 cattle were put in an open stable, they attracted nearly half of the sinensis. Apparently it was chiefly a question of the relative numbers of men and animals. If there were only enough animals of an attracting kind present, the sinensis visited them in large numbers.

Turning now to the second graph (fig. 2), which represents an epidemic in rice field areas, (Javanese "sawah"), we find sinensis infected to a much higher degree (at times nearly 22 per cent against a maximum of 6 per cent in the first epidemic), but here again when later on we put buffaloes in an open stable near the dwellings they attracted the sinensis to a marked degree. One buffalo for about 20 men proved here to be able to divert nearly all the anopheles from the men. In these two cases the sinensis were not very prolific. I must state that in the future to make such observations complete, it will be necessary to carry out the test of King and Bull to determine whether the blood contained in the stomach of the mosquito is human or animal.

Another possibility that might explain why the sinensis sometimes is an important carrier and on other occasions seems to play no role in the transmission, is that there are two varieties of sinenses of different susceptibility. The sinenses in the cases under discussion were of the vanus type. In the second epidemic more attention was paid to this point. The most important differences of the females of the M. sinensis type and the vanus variety are to be found in the wing. The yellow spot on the costa at the end of the subcosta does not reach as far as the first longitudinal vein, when we have to deal with a vanus (fig. 3), but does so, when we have to deal with a sinensis (fig. 4). The vanus has however in many instances an accumulation of yellow scales on the corresponding part of the first longitudinal vein (fig. 5). The above-named spot on the costa, as a rule, is smaller on a vanus than on a sinensis. (Christophers and Khazan Chand,[2] Swellengrebel.[3])

Another point that is clearly illustrated by the first epidemic that we referred to, is that in order to get a good idea of the cause of a malaria epidemic, so far as the anophelines are concerned, it is generally necessary to dissect a great number of them during a period of time that is sufficiently long. When (in fig. 1) we compare the diagram of infected mosquitoes with that of the malaria among the coolies, it immediately appears that the sinenses and the ludlowi each had their own turn in which they were the principal carriers, as in the beginning the sinensis was the cause, whereas the second aggression of the malaria was due to a high summit in the number of infected ludlowi.

Furthermore, while studying an epidemic it is not sufficient to mention alone the natural infection index of the anopheles, but it is necessary also to reckon with the total number of captured anopheles in order to ascertain the relative importance of the different carriers. In the first epidemic, it appears from the following table, that though the infection index of the sinensis is lower than that of the other two carriers, still the former is the most important, because of its far greater numbers.

	No. dissected	No. infected oocysts in stomach	per cent infected
M. sinensis (1919-1920).....	14599	151	1.1
M. ludlowi	422	65	14
C. kochi	229	12	5.2

It is worth while considering also the number of oocysts per infected mosquito. Swellengrebel and Schuffner are of the opinion that a high average of oocysts per infected mosquito will denote as a rule a severe epidemic. Schuffner, who worked about 25 years in Sumatra, furthermore defends the view that, when a highly susceptible anopheles is present and at the same time a sufficient number of gametocyte carriers, the conditions for a malignant malaria are created. Such a situation is likely to occur when a group of new-

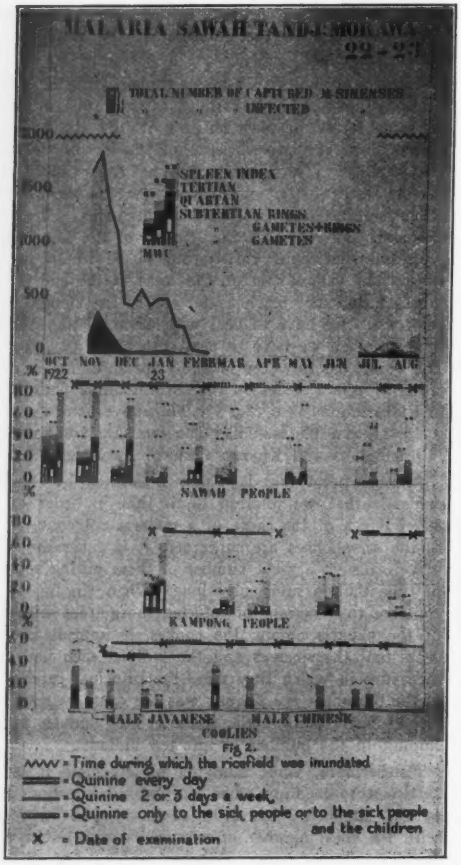

Fig. 2

comers enter an endemic center. In such a region the anopheles generally have a small number of cysts and as we shall see later on the number of gametocytes also is relatively small. But as soon as recent infections in the newcomers develop the number of gametocytes rises. The mosquito under such conditions has the opportunity to develop a great number of cysts and afterwards of sporozoites. Schuffner now makes the plausible supposition that a greater number of sporozoites injected into the blood of a man, will occasion a more severe malaria than an injection of a smaller number of sporozoites. The result is that there will develop cases with many parasites, including many gametocytes and the circulus vitiosus, which will give rise to a severe epidemic, is produced. In this respect it is interesting to note that in the first epidemic apart from the higher infection index, the ludlowi also showed its greater individual danger by the larger number of cysts that it possessed. From the following table can be seen that on an average an infected ludlowi had thrice as many cysts as an infected sinensis.

	No. infected	Total No. of cysts	Av. No. of cysts per inf. mosquito
M. ludlowi	56	2835	51
M. sinensis	122	2077	17

Before leaving the general discussion of the carriers as it was illustrated by the two graphs, I should like to draw your attention to the fact that in both cases at the close of our observations another mosquito took the place as the prevalent species, the M. vaga. As this anopheles is of very little importance as a carrier (we dissected several hundred of them, without finding any infected), this change was a most favorable one. In the second epidemic, after what we had observed in the first, we were inclined to try by introducing larvae of the vaga, to supplant the sinensis. Ross already had suggested such a measure. Nature, however, in our case accomplished the change.

A study of the relation between the properties of the water, the food that it contains and the occurrence of a certain species of larvae promises to explain at least something of those changes. In this respect I need not draw your attention to the investigations in which Dr. Barber is engaged and which he gave me an opportunity to see last summer.

If I had to state in a few words the gist of what has so far been discussed, I should say that it is that each epidemic has to be studied for itself, and the time for broad generalization has not yet come.

Having thus considered the role of the anophelines we will now pass to the human factor in malaria transmission, in so far as its carriers are concerned. By investigating the people exposed to the disease the tendency today is more and more to examine as a routine both blood and spleen. As far as the former is concerned, we believe it a good practice to make when possible on one slide a thick drop as well as a thin film. If so desired both can be stained at the same time. For diagnostic purposes it is not necessary to fix the thin film before staining. The thin film is only looked at if the examination of the thick drop leaves some doubts as to the nature of the parasites.

The best method to measure and record the enlargement of the spleen in my opinion is the one described by Christophers in his usual scientific way at the last congress of the Far Eastern Association of Tropical Medicine at Singapore. I know no better way than to refer you to the transactions of that meeting and to his papers in the Indian Journal of Medical Research, vol. XI, No. 4, 1924. The principle is that the enlargement of the spleen is measured in centimeters and that at the same time some anthropometric measurement (sitting height, nipple umbilicus line) is taken, that indicates the size of the individual and allows of correction. Furthermore it is pointed out that due to the variation in the position of the costal margin, the method of measuring the spleen by the amount of projection of this organ below this margin, can give

only vague information. It seems to me that it is especially of importance in countries where there are a great number of considerably enlarged spleens. Christophers therefore suggests determining the position of the spleen by taking two measurements: (a) the distance of the apex of the spleen from the umbilicus; (b) the distance of the same point from the middle line of the body. So far the method has been worked out only for children.

In recent years Schuffner in our colonies has recommended including in the study of the epidemiology of malaria the examination of the blood and spleen of adults as well as children. We do not intend to say that when a rapid orientation is desired it is necessary to carry out all these methods of investigation. For a rapid survey no method is superior to the splenic index of children. The value of this procedure under the conditions met in the southern part of the United States has been dealt with in an authoritative way by Darling at the meeting of this association in 1923. In the Dutch East Indies all information that is available should be used; on account of the seriousness of the problem a complete examination is indicated. Refer for details to Schuffner's article in the Reports of the Dutch Indian Civil Medical Service of 1919, (part IX). I should like to mention here his most important conclusions. I must emphasize, however, that I do not wish to submit them as definite facts, but only as a valuable basis for further investigation and discussion.

Schuffner gives the following differences between the blood picture and the splenic indices in the case of an acute outbreak of malaria and a really endemic malaria:

(1) In the case of the former the spleen rate usually is not very much higher than the parasite index. Sometimes, even, the parasite index will exceed the splenic index. In case of the latter the parasite index is very much lower than the splenic index. The former will be, for instance, one-third or one-fourth of the latter.

(2) In so far as the subtertian is concerned the typical epidemic is characterized by a high percentage of gametocyte (crescent) carriers, perhaps 75 per cent, whereas in endemic malaria this percentage is low, (about 25 per cent).

(3) However in the above-named respects a declining epidemic would not differ from the chronic endemic malaria. But in the case of the former and of the acute outbreak as well, the children and adults have about the same parasite index, whereas in the endemic area the parasite index will decrease with increasing age.

The accompanying charts (fig. 1 and 2) will show you a practical application of the methods of examination described above. You will notice that for obvious reasons the gametocyte carriers of the subtertian are indicated separately.* In the first epidemic where in the chart only the malaria of the adults is represented, we had to deal apparently with an acute outbreak; the parasite index was higher than the splenic index. There was a large percentage of crescent carriers. Through the influence of the quinin the picture changes; the parasite index diminishes more rapidly than the splenic index and the latter is now bigger than the former. As soon, however, as the ludlowi occasions a recrudescence, the parasite index rises again above the splenic index and the relation of the two is again that of an acute outbreak.**

Turning now to the second epidemic, where the malaria of men, women and children has been represented separately, we see that in the beginning the people of the rice field sections ("sawah") showed a somewhat complex picture. The children have a parasite index that equals the splenic index. We should be inclined therefore to think of an acute outbreak. In accordance with this fact in adults the parasite index is still relatively high (about ¾ of the splenic index).

But the relative number of crescent carriers was not very high (somewhat more than half the total number of subtertian patients) and the percentage of attacked children is higher than that of the adults suffering from malaria. The latter fact especially, would not be observed in an uncomplicated acute outbreak. It is explained, however, when we consider that the adults had already taken some quinin voluntarily.

The relatively low number of crescents might indicate that the epidemic had not started very recently. That this was indeed the case, was clearly demonstrated by the slow way in which the spleens, (especially of the children) diminished in size after the administration of quinin.

In figure 2 the results are shown of the examinations of Javanese coolies who first worked in the rice field; of the Chinese who worked later on in its neighborhood and of the inhabitants of a native village (Malay "kampong"), situated quite close to the rice field. The administration of prophylactic quinin (½ gram hydrochlorid 3 or 2 days a week) to the Chinese, especially in the beginning, was not very effective. This was due however, largely to the fact that they did not like taking quinin, when they did not feel sick, and upon inquiring we learned that a good deal of the medicament did not pass their throats. To the same cause may be attributed the fact that the children of the rice field scarcely improved in the beginning. As soon as the treatment, however, was carried out under daily control of the European supervisor, the children improved rapidly. (December-January 1923.)

The effectiveness of the quinin is also clearly demonstrated, when we compare the village people with the laborers of the rice field in the month of January, 1923. The former were heavily infected, the latter had only a relatively small number of parasite carriers. The conditions of environment were quite the same;

*On the second chart the people who have rings and crescents are again separated from those with crescents only. When quinin has been given for a longer time, this group ought to be small. In this way a certain control upon the effect of quinin is possible.

**It will be noticed that the crescent carriers are not very numerous this time; the conclusions of Schuffner cited above, however, do not hold strictly when quinin has been administered.

the only difference between the two groups was that the inhabitants of the rice field had already taken quinin for some months and the other people scarcely any at all.

This brings us to a discussion of the therapeutic measures. I need not speak here about drainage, oiling, etc., the effectiveness of which nobody will take exception. I should like to mention however, the question of catching adult mosquitoes under certain conditions, as a means of control. Though advocated by such men as Ross, Gorgas, and LePrince, it does not get perhaps the consideration which it merits. In our colonies Schuffner has defended it strongly. Personally, especially when having to deal with well-disciplined native laborers, I have always practiced it. In the first epidemic, in the beginning, mosquitoes were caught by a small mosquito-brigade only, but starting in May, 1921, the whole population, including children, was armed with catch tubes, made of bamboo, and a small reward was offered for each captured anopheles. The effect was very striking. Before this the greatest number of anopheles we obtained in one month was 6000, but after the new scheme it mounted at once to 33,000 (in a population of only 800). Before May, of course there were some variations, but such a big increase, followed by an equally big fall (down to 3-4000 a month under intensive catching) had never previously occurred. We strongly believe that this fall was the result of the annihilation of so many adult females.

In the second epidemic we started immediately the intensive catching. From the chart is to be seen that there was a substantial drop in the number of anopheles before the rice field was drained.

Another point which we have already touched upon, but which merits further consideration, is the protective role of animals. The general tendency in the Dutch East Indies is to believe that the cattle have indeed value in this respect. As already stated above it seems that the relation between the number of cattle and of the men who are to be protected, is an important factor. In Belawan, the harbour of Medan (East coast of Sumatra) Schuffner and Hylkema[4] succeeded in protecting about 80 men by 1 buffalo, our most attracting animal. They had to deal with an epidemic of ludlowi, but the sinensis also entered the stables readily. In our first epidemic, 1 buffalo was not able to divert sufficiently the mosquitoes from about 100 men. Even when we brought a buffalo from Belowan, where he had done good service to our coconut plantation, he did not prove sufficiently attracting in his new environment. But later on a group of cattle, 5 times as big, did the work very satisfactorily. This whole question however, is still in the phase of investigation. Recently Mangkoewinoto[5] in two series of experiments, conducted in different places and each extending over a period of from about 60-80 days, observed that on one of these occasions the buffaloes as compared to men were much more attractive for the same species of anopheles (M. aconita) than the other time.

This brings me to the end of this brief survey. I feel certain that I could not give you nearly so good an idea of the way in which we study the malaria over there as I obtained of the work done here during my stay in this country. If, however, it has been of only some interest to you, my aim is nevertheless secured.

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MEDICAL RESEARCH IN MALARIA*

By R. W. HEGNER, PH.D., AND ASSOCIATES,
School of Hygiene and Public Health, Johns Hopkins University,
Baltimore, Md.

The following is a brief outline of the work done during the past year by members of the Department of Medical Zoology, School of Hygiene and Public Health, Johns Hopkins University.

(I) Efforts have been made to discover a therapeutic agent equal to or better than quinin. This work has been in progress since July 1, 1923, under the direction of Dr. Hegner, with Dr. G. H. Boyd in charge from July 1, 1923 to June 30, 1924, and Mr. Ernest Hartman in charge since July 1, 1924. Synthetic quinin derivatives have been obtained from Dr. Jacobs of the Rockefeller Institute and these have been experimentally used on canaries suffering from bird malaria. The result desired is to find an agent that will bring about the destruction of all of the parasites in the body of the host and hence prevent relapse.

(II) The relation of malarial organisms to mosquitoes in nature has been studied. Dr. F. M. Root spent the summer of 1923 at Leesburg, Georgia, dissecting mosquitoes in order to determine which species actually transmit malaria. His results are not yet available.

(III) Complement fixation tests have been attempted for malaria carriers. The work was begun by Drs. H. C. Clark and R. W. Hegner at Tela, Honduras, during the summer of 1924 and will probably be continued during the coming school year.

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*Report from Member of Sub-Committee on Medical Research, National Malaria Committee (Conference on Malaria), meeting conjointly with Southern Medical Association, Eighteenth Annual Meeting, New Orleans, La., Nov. 24-27, 1924.

PROBLEMS FOR FURTHER STUDY

(I) Studies should be made of the life-cycle of malaria parasites in the vertebrate host. Questions of importance are:

(1) Where are the parasites located in the body at various stages in the course of the infection and in what stages in their life-cycles? The distribution of the stages is known to differ in falciparum from that of the other two species. Why do specimens of falciparum clog up the capillaries? What factors bring about these differences in distribution, etc., and what are their relations to virulence, latency, relapse, etc.?

(2) Is the malarial parasite inside or outside of the red cell? In all stages? Do the parasites migrate from one cell to another?

(3) Is there a filterable stage in the life-cycle, especially during the period between relapses when no parasites can be found in the peripheral blood?

(4) When and where, does the change take place from schizonts to gametocytes? Factors? Does the sex of the host have any influence on the production and sex of the gametocytes?

(5) If the falciparum disappears and vivax takes its place as is claimed by some, what are the stages in this change and how is it brought about?

(II) Studies are likewise needed of the life-cycle of malaria parasites in mosquitoes.

(1) In nature, what is the influence of temperature moisture, latitude and altitude on sporogony in the mosquito? Length of different stages? Numbers of oocysts? Numbers and distribution of sporozoites?

(2) Effects of starvation, diet, etc., on stages in life-cycle in mosquitoes? Duration of stages? Numbers? Length of infectivity?

(3) Are stages in sporogony as worked out by Grassi correct?

(4) Does the environment of the mosquito or its larva or pupa have any effect on its infectivity? Humidity, temperature, salinity of water, altitude?

(5) Are different species of mosquitoes responsible for the appearance of vivax early and falciparum later in the season?

(6) Are mosquitoes responsible for the local appearance of malaria? Plasmodium malariae may be abundant in a spot surrounded by vivax and falciparum but free from malaria.

(7) Do mosquitoes suffer from infection? Do non-infected mosquitoes live longer than infected mosquitoes?

(8) Effects of hibernation and estivation on sporogony? Do oocysts degenerate?

(9) How many gametocytes are necessary to infect mosquitoes?

(10) How many oocysts are necessary to produce an infective mosquito?

(11) Are mosquitoes susceptible to mixed infections? Can they transmit them to man? If they can, does this prove plurality of species?

(12) There exist relatively impossible mosquito hosts. Why is there not infection in all hospitable hosts?

(III) Problems of relapse in malaria are concerned with:

(1) Parthenogenesis. What is the status of this phenomenon?

(2) Do old red cells become immune? Are young cells more frequently parasitized? Would relapse result from rapid increase of young cells?

(3) Is relapse due to changes in blood plasma which make it easier for merozoites to parasitize cells, or to changes in the inhibiting power of leuocytes?

(4) Can relapse be brought on after administering quinin?

(5) What is responsible for latency, i.e., the period between inoculation and symptoms?

(6) The changes in the body that are responsible for relapses may be determined by determining the constant factor of altitude, cold, etc., and provocatives.

(7) Is there a resistant stage or unknown stage of parasite that brings on relapses?

(IV) The species problem is in many ways unsettled.

(1) Is there a *tenue* stage in the life-cycle of falciparum?

(2) Are the species in man and primates the same?

(3) How many human species are there?

(4) Are there two species or subspecies of falciparum?

(5) If a mosquito is fed on mixed infection will it transmit a mixed infection?

(6) Is virulence related to different races of parasites?

(V) What is the relation of parasite to the resistance of host and blood reactions?

(1) Is immunity acquired?

(2) Is complement fixation in malaria with antigens prepared from the cultures or organs?

(3) What is the relation between the number of parasites in the blood and clinical symptoms?

(4) What brings about clinical symptoms?

(5) Does dengue give immunity?

(6) What is responsible for the pathogenicity of falciparum?

(7) Do provocatives increase asexual reproduction or force parasites out into the blood?

(VI) What are the effects of quinin on parasites?

(1) Effects on various stages of different parasites in blood?

(2) Quinin prophylaxis under controlled conditions.

(3) Effects on parasites in non-quininized cases after various types of doses.

(4) Effects on mosquitoes of ingesting blood containing parasites as well as quinin.

(VII) Identification of carriers might be possible through study of:

(1) Spleens.

(2) Complement fixative.

(3) Leucocyte method.

(4) Thick and thin films.

MEDICAL RESEARCH IN MALARIA*

By S. T. DARLING, M.D.,
International Health Board,
Leesburg, Ga.

During the years of 1923 and 1924 there has been in operation by the International Health Board, at Leesburg, Georgia, a Station for Field Studies in Malarial Control. Here observations and studies are being made on the natural history of malaria as it occurs among people in the district. Studies of the anopheles species and their habits are also being made. Beside these studies instruction is given in malariology to medical officers and others interested in the subject.

Leesburg, Georgia, was selected because of the severity of the malaria in the district, for it is only possible to study malaria and give instruction on the subject where the disease is abundantly present at all times during the warm season, and where latent malaria is present during the cooler months. Efforts at first were directed to ascertain the specific nature of the problem in the locality, afterwards to extend the investigation outwards into other regions until the problem of malaria in the Southern States has been more or less envisaged.

Experience elsewhere has shown that, because of differences in the mosquitoes and their habits and in climate and topography, and because of economic reasons, each region presents peculiarly specific problems. Therefore it was decided to take little or nothing for granted but to investigate as carefully as possible the problems of the locality, for if there were specific problems calling for special methods of control, waste of money, time and effort might be avoided by carrying out the control measures in places only where they were needed.

METHODS OF STUDY

There was found to be considerable advantage in working continuously in the locality through two rounds of seasons for in this way a most intimate knowledge of all phases of the problem is obtained. Inasmuch as the first year of residence was a year of heavy rainfall in which breeding and mosquito density were abundant while in the second year there was a prolonged dry season during the summer and fall, there were opportunities for studying the effect of rainfall and drought on anopheles production and on malaria.

Malarial surveys were made in the schools and on the plantations. Careful histories, spleen examinations and blood examinations were made. A number of stations were established on the plantations and elsewhere for the purpose of measuring as accurately as possible the incidence and density of anopheline mosquitoes throughout the seasons. Care was taken to select stations which would yield information in regard to the habits of all three species of anopheles. Those which presumptively were transmitters of malaria, as well as other suspected ones, which are always found feeding on man. An attempt was made in every case to trace the adult mosquitoes found back to their breeding place, a matter of very great importance in malarial control work.

Malarial Surveys.—Malarial surveys were made at first at the schools for there the population is segregated and can be conveniently sampled and examined, but as it was desired to compare the numbers of children whose spleens were enlarged and whose bloods were positive for malaria with those which gave a positive history, the surveys were carried out later on the plantations where parents could be interrogated. The plantations were visited, children and parents were assembled, and careful histories taken. Spleen examinations were made, blood was obtained for the hemoglobin test and to determine the incidence of infection. At the same time adult mosquitoes were collected inside and under the houses and outbuildings and collections of larvae were made from all breeding places within flight distance of the premises. Both white and colored children were used in the survey. Children between the ages of two and twelve years only were used in the determination of the spleen index, for the reason that it is slightly more difficult to determine splenic enlargement in children under two years of age, and in those over twelve years, than between these years, and because in an endemic region splenic enlargement is less apt to occur after the age of puberty.

The spleen becomes an important means for the detection and measurement of malaria from the fact that malarial infection is a condition in which on the whole the deeper viscera are more apt to be involved than the peripheral blood, which latter sometimes represents an overflow from the deeper organs where the great drama is being enacted. During infection mature and segmenting forms often retire from the peripheral blood to the deeper viscera. After the administration of quinin the peripheral blood is more thoroughly cleared of parasites than are the internal organs, particularly the spleen and bone marrow. Even after apparent cure, relapses often occur from the multiplication of parasites which we believe were lying in the blood spaces of the spleen and marrow. The spleen enlarges during malarial infection and in relapse and it remains enlarged in cases in which parasites have to some extent become either very sparse or have disappeared from the peripheral blood. In as much as plasmodia are more apt to be found in the deeper viscera than in the peripheral

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CONDITION OF SPLEEN IN RELATION TO MALARIA INFECTION
Colored Boys and Girls Previous to August 1

Spleen	Negative	Palp. Insp.	Palpable	1 f. b.	2 f. b.	3 f. b.
Number of cases examined	267	17	104	20	23	15
Number of cases positive blood	30	4	30	8	13	11
Per cent of positive blood	11.23	23.53	28.84	40	56.52	73.33

blood, the examination of a viscus like the spleen should give us more information as to the presence of infection than the examination of the peripheral blood when for the purpose of measuring malaria in any locality numbers of cases are considered. Spleen rates were determined at least twice on some of the plantations so that we could learn how the rates were influenced by seasonal changes in anopheles density. The spleens varied considerably in size and they were conveniently measured by the number of finger breadths which the lower margin was found to reach or extend below the costal margin. Various methods have been devised for the measurements of enlarged spleen but some are difficult to use for the reason that in the smaller degrees of enlargement encountered in the Southern States the spleen is not always found exactly in the same relation to the anterior axillary line. Sometimes its position is low down in the flank, at other times nearer the nipple line. On this account a simple method of measuring by finger breadths was used which was found to yield valuable information. Following is a classification of the degrees of splenic enlargement:

(1) Negative on deep inspiration.

(2) Palpable on deep inspiration.

(3) Palpable on normal inspiration but not 1 finger breadth below the costal margin.

(4) One (1) finger breadth below costal margin on normal inspiration.

(5) Two (2) finger breadths below costal margin on normal inspiration.

(6) Three (3) finger breadths below costal margin on normal inspiration.

A definite relationship was found to subsist between the size of the spleen and the amount of malaria as measured by the presence of plasmodia in the peripheral blood.

In the above table is seen a correspondence between splenic enlargement and the presence of plasmodia in the peripheral blood, for in a group of cases those presenting the higher degree of splenic enlargement are more apt to reveal plasmodia in the peripheral blood than those with the smaller degrees of enlargement, but it is to be noted that all enlarged spleens are of malarial origin and that the spleen palpable only on inspiration is indicative of malaria as well as the spleen two or three fingers breadth or more below the costal margin.

Method of Examination.—In communities where malaria is light and when, during the cooler months the infection has subsided, spleens of the smaller degrees of enlargement only may be encountered. In order that this smaller degree of splenic enlargement may be detected, for the better examination of any spleen and for the determination of the malarial index, it is necessary to place the child to be examined in a recumbent position with the thighs and legs flexed. The clothing should be previously loosened so that the hand or fingers of the examiner may be easily and freely placed upon the bare skin of the abdomen. If the spleen is not palpable the child is instructed to take a deep breath. With the tips of the fingers of the right hand held just below the costal margin slight pressure is made just as the child takes a deep breath. At this moment if the spleen is enlarged it may be felt as it descends, being pushed down by the diaphragm. Care must be taken not to press too deeply for then tension on the abdominal wall will prevent the spleen from being felt as it moves under the tips of the fingers.

Histories.—When histories were carefully taken and compared with the spleen and parasite rate it was found that the spleen rate corresponded more closely with the history rate than did the blood rate, although when the malaria became severe after the first of August, blood rates reached a higher level but never equalled the spleen rate or history rate.

In taking histories there is some difficulty in interpreting the statements or replies of the persons questioned. Straightforward histories of chills and fever presented no difficulties, but among persons and in regions where malaria was light, histories of fever, headache and fever, or merely headache would sometimes be elicited. Upon examination of blood specimens, positive cases of malaria were detected in some persons who gave a negative history. In view of the difficulties of eliciting from children or from parents histories which may be relied upon and in view of the correspondence between positive histories when carefully taken and of spleen rates from the same group of persons, and the findings recorded here, it is recommended that the spleen be used whenever possible as an index in the measurement of malaria.

Blood Examination and the Parasite Rate.—The blood smear merely represents a very small sample of the blood which may be infected. Infections may be light or heavy. Plasmodia may be segregated in the deeper viscera and there may be few or many of them in the peripheral blood. In our experience technicians have more confidence in their findings when using the thin film for diagnosis. A record of the time taken to detect

COMPARISON OF THE HISTORY, SPLEEN AND BLOOD RATE OF THE NEGRO CHILDREN

Months	Histories			Spleens			Bloods		
	Total No.	No. Pos.	Per Cent Pos.	Total No.	No. Pos.	Per Cent Pos.	Total No.	No. Pos.	Per Cent Pos.
July, Aug., Sept.	483	190	39.3	483	181	37.4	483	109	22.5
Oct. and Nov.	339	222	65.5	339	234	69	339	178	52.5

plasmodia and the time spent on the so-called negative slide has been kept for the purpose of ascertaining the average length of time which should be spent on a slide before it is called negative. Slides which have been called negative on one occasion have revealed plasmodia upon a more thorough search. A negative report therefore is a qualified and relative one and means nothing more than that during the time spent in the examination of the slide by a certain microscopist plasmodia were not detected.

Hemoglobin.—Very interesting and valuable information has been elicited from the analysis of hemoglobin records of the children furnishing the spleen and parasite rates in the malarial survey. For the purpose of valid comparisons it is necessary to divide the cases into age groups. When this is done a striking correspondence between anemia and splenic enlargement is seen, for the greater the degree of splenic enlargement the lower is the average hemoglobin of the groups. This is particularly true in the age groups 2 to 5 years. When the hemoglobins of the whites are compared with those of the negroes it is found that the hemoglobins of the negroes are set 9 to 10 points lower than that of the whites, and this is due almost entirely to the malaria from which they suffer.

Natural History of Malaria (Givens Experiment).—An extended series of observations has been made to ascertain just what is the natural course of events in a family, all members of which are infected naturally with malaria. They lived in an environment unprotected from the anopheles quadrimaculatus which was breeding close by and had little or no quinin medication except for a period during the test, and they were probably suffering from some undernourishment.

This study was one of chronic malaria as manifested by clinical symptoms, splenic enlargement, anemia, and by the presence of plasmodia in the peripheral blood. A family of negroes, including the mother and four children, were examined at weekly intervals for a period of more than a year. At each examination individual histories were obtained, the spleens of the children were palpated and measured by the method described above, the hemoglobin percentages were estimated using a Dare hemoglobinometer, and blood smears were taken for the estimation of the numbers of gametocytes and parasites per 500 fields.

The mother was 32 years of age, the children were 9, 6, 4, and 2 years respectively. There were two boys and two girls. They lived in an open house devoid of screens. Adult female anopheles quadrimaculatus mosquitoes had been caught inside the house. Three successive crop failures had reduced the family to poverty, but the children did not appear to be grossly underfed. They were not infected with hookworms, two examinations for ova being negative. There was no history of syphilis and no evidence of it in any member of the family. They had had no acute infectious diseases during the year. The family appeared to be thoroughly typical of others in Lee County, Georgia.

Symptoms.—There had been comparatively few acute episodes during the year. The mother had had chills in the five months when her blood showed parasites. The girl, age 9, had four chills during six months while her blood was positive. For two weeks there was tenderness over the spleen. The boy, age 6, had had no chills, although his blood contained parasites for five months. The boy, age 4, had had only one chill during twelve months when, for a period of only two weeks his peripheral blood had been negative. He had had as many as 300 parasites per 500 fields without enough malaise to impress his mother sufficiently so that she would report it. The girl, age 2, had had ten chills in twelve months, her blood being negative only four weeks of this period. She had had periods of fever and headache occasionally. All of the children appeared normal and none looked chronically ill.

Parasites.—From the time of the first examination in November, 1923, until the beginning of an eight-weeks' treatment (standard treatment) in March, 1924, each of those negroes had shown parasites in the peripheral blood. The numbers of parasites ranged from 700 per 500 fields to 1 per 500 fields, and of gametocytes from 65 to 1 per 500 fields. The mother had had all three species of parasites in her blood. The girl, age 9, had also had all three species in her blood. The boy, age 6, had had only quartan parasites; the boy, age 4, only subtertian parasites; and the girl, age 2, had had tertian and subtertian parasites. Some of the parasites found in the blood of this youngest child had on four occasions resembled the Plasmodium tenue of Stephens.

During the periods of treatment the two younger children continued irregularly to show parasites including gametocytes, probably because the treatment was not given regularly by the mother. After the period of treatment, the girl, age 9, and the boy, age 6, remained free from parasites in the peripheral blood up to the present, a period of eight months. The mother remained negative until October, 1924, when she had at first many subtertian rings and then a week later many crescents in her blood smears. The two youngest children have continued to show the same types of infection after treatment as before.

Gametocytes.—Excepting for two weeks in March, two in April, and three in May, one or more members of this family have at all times been carriers of male and female gametocytes in sufficient numbers to be infective.

Hemoglobin.—In general, the hemoglobin curve has inversely followed the parasite curve. In each case but that of the girl, age 9, it reached its highest peak after four weeks of quinin treatment. In every case during treatment there was a rise in hemoglobin percentage for about four weeks and then a fall. The range in percentage of hemoglobin has been as follows:

Mother, 64 to 89; girl, age 9, 56 to 88; boy, age 6, 65 to 90; boy, age 4, 46 to 87; and girl, age 2, 46 to 88.

Spleens.—The mother's spleen was not examined.

The children have had palpable spleens at all times. Those of the girl, age 9, and of the boy, age 4, have

ranged from palpable to the umbilicus; that of the youngest child has always been large, ranging from 2 finger breadths to pelvis; and that of the boy, age 6, was 2 finger breadths before treatment. This was reduced to palpable on inspiration during treatment and has remained in that condition since. Although the treatment caused all parasites to disappear from the peripheral blood of the girl, age 9, it had very little effect on the size of the spleen. In every case the size of the spleen has varied somewhat from week to week, notable increase in size coming about a week after a notable increase in the number of parasites in the peripheral blood. The spleens have always been moderately firm in consistency and never tender excepting for two weeks in the case of the girl, age 9.

An Experiment With the Standard Quinin Treatment.—This was to ascertain the effect of standard quinin treatment in reducing the size of the spleen of children living in a malarial community and it developed out of a suggestion made to us by Dr. M. A. Fort. The experiment was conducted by selecting some 75 children in a malarious region in a neighboring county. All the children had enlarged spleens and had suffered from malaria the previous summer. The children were selected early in the spring, and were divided in two groups: 50 children were to receive the standard treatment, and 25 were to be used as controls. The controls had spleens of the same degree of enlargement and were brothers or sisters and lived in the same houses and under the same economic and environmental conditions as the experimental cases. The children in both groups have been carefully examined at intervals of about a month since the experiment began. Some of the results may be reported now.

The standard treatment will remove plasmodium from the peripheral blood for as long a period as it is maintained. During this time there is a progressive reduction in the size or mass of the spleen in each type of enlargement. It is more marked in the larger sized spleens than in those palpable or palpable on inspiration. In the control cases untreated by quinin, there was a slight increase in the size of the spleen while, at the same time, the spleen of those under treatment was steadily reduced in volume. The quinin treatment was continued during a period of ten weeks. Following its discontinuance there was noted a gradual increase in the spleen mass of all groups of cases.

The increase in the spleen rate after the conclusion of treatment appeared not only in the treated group but among the controls as well. This was due in part to new infections and undoubtedly in part to relapse because many of the spleens in the treated group had not been reduced by treatments to normal volume and such enlargement as persisted we believe is due in part to latent malarial infection. During the course of the experiment observations were made which tended to show that hard work in the fields under the hot sun, plowing or harvesting peanuts or other heavy crops, provokes relapse in treatment cases even when plasmodia have been driven from the peripheral blood, and that this economic factor militates somewhat against success in malarial control by the standard treatment. Comparing the results of the experiment with standard quinin and with the quinin administered to the Givens family it is seen that the success is only attained when the quinin is given in proper dosage regularly by responsible persons.

Blackwater Fever.—Blackwater or hemorrhagic fever has been found to occur in many regions of severe malarial endemicity. During 1923 there was an opportunity for observing several cases of this disease in Lee County. During the year six deaths occurred. Not all of these were seen or investigated, but the histories elicited left little doubt as to the correctness of the diagnosis. The cases occurred during late summer and fall when malaria throughout the county had reached a high degree of intensity. They occurred on farms where anopheles quadrimaculatus was breeding abundantly, where spleen rates among the negro children were high and in a number of instances where infected specimens of quadrimaculatus were found in the negro quarters. All cases occurred among whites. The disease presented no feature different from those seen in other countries.

There was, however, one epidemiological feature which may have some significance. In a number of instances houses were pointed out in which two deaths or several cases of blackwater fever had occurred in one family. Inquiries elicited the information that sometimes these cases or deaths occurred within a short period of time. In other instances a greater period of time had elapsed between the occurrence of the disease in a mother and son, or grandparent and grandchild. Usually these cases occurred on one farm or in one household so that severity of malaria in the immediate neighborhood might be considered as one of the factors. This "house" or family susceptibility, however, taken in connection with circumstances just mentioned, leads one to suspect that the hemolysis in blackwater fever may be due to an anti-hemolytic mechanism rendered defective in certain familial groups of persons by attacks of malaria and that this peculiar defective mechanism is heritable. Furthermore, on account of the absence of this disease among pure-blooded negroes, many of whom suffer from malaria to the same extent as the whites who have blackwater fever, and in view of the well known fact that races and individuals possess types of blood constitution, there is a possibility that only a certain group of persons is susceptible to the disease and that this susceptibility is heritable.

Treatment of Blackwater Fever.—An important advance in the treatment of this disease would appear to have been made by Dr. O. L. Cranford, of Sasser, and Dr. O. W. Statham, of Leesburg, Georgia. Dr. Cranford first conceived the idea of treating cases of this disease with anti-streptococcic serum believing that he was dealing with a disease upon which had been engrafted a streptococcus infection. Dr. Statham, following Dr. Crawford's lead, has treated some thirty odd cases of the disease with a very low mortality rate. His method of procedure is to discontinue quinin and give 20 c.c. of anti-streptococcic serum at once sub-

cutaneously. Certainly in the hands of Dr. Statham this treatment has given very much better results than have been obtained by many doctors elsewhere in the tropics. The rationale of the treatment would seem to be that the horse serum furnishes an anti-hemolytic substance to the blood of the blackwater fever patients supplying an element which had been rendered ineffective because of the disease.

These are among the more essentially medical subjects dealt with at the station. In addition to these the following subjects have received attention, and some of them reported separately to the Sub-Committee for Malarial Research:

(1) Malarial survey of Lee County and of districts in neighboring counties.

(2) Special anopheline surveys in various regions in Georgia, Alabama and Tennessee.

(3) Identification of the species of anopheles by the anatomical characters of the larvae, reported as a special paper by Dr. Paul F. Russell.

(4) Feeding habits of anopheles mosquitoes as determined by the precipitin test.

(5) Limnological studies of the water of anopheles breeding places, by Mr. Lowell T. Coggeshall.

(6) Observations on the entrance of anopheles quadrimaculatus into houses by way of chimneys.

(7) Observations of the flight and dispersal of anopheles from breeding places.

(8) A study of the microsporidia parasitic in mosquitoes, by Dr. R. Kudo.

(9) Determination of the infection rate of anopheles quadrimaculatus, anopheles crucians, and anopheles punctipennis.

(10) Preliminary study of the topographic and geologic features of the limesink region of the Dougherty Plain in relation to the engineering problem of drainage, by Mr. F. F. Longley.

The study to define the nature of the malarial problem in this region involved a variety of subjects dealing with the habits of the anopheles mosquito, the distribution of anopheles, the relation of their breeding places to topography and soil condition. As the species were found to possess different degrees of susceptibility to infection by malaria a detailed study of the breeding places of each species has been carried out in order that we might learn whether it would be possible to carry out species control, or the control of malaria by giving attention especially to the species which is the effective carrier of malaria. So far as our work has progressed it would seem that there is some justification for the statement that species control is possible and practicable, and that methods for the control of malaria in the Southern States should be derived from studies and experiences in the South and not from the experiences of others in parts of the world where problems are different in nature from ours. We should aim at an intelligent control based on positive knowledge derived wherever necessary from field studies made in our own communities. Such intelligent control will necessitate the special training of men who are to engage in malaria work, and this can best be done in the field where experience can be obtained by a study of conditions as they really exist.

ENTOMOLOGICAL RESEARCH IN MALARIA*

By W. V. KING, CHAIRMAN,
U. S. Bureau of Entomology,
Mound, La.

In preparing this report for the National Committee I have included, in addition to a review of the activities of the members of the sub-committee, a brief mention of some of the more important investigations in different parts of the world, so as to give something of a picture of the entomological developments during the past year.

The subject of the host preferences of anopheles has continued to attract considerable attention, but the opinion of American workers seems to be that the possibilities of using animals as an effective protection of humans against our species are very doubtful. The work of Bull and Reynolds which was discussed at this meeting last year and which has since been published, demonstrated quite clearly that man could not be wholly protected from quadrimaculatus when equally exposed or even when the opportunities for feeding were in favor of the animals. From field observations Barber and Hayne concluded that quadrimaculatus and crucians show no special predilection for domestic animals over man when such factors as size and amount of exposure are excluded. With certain other species of anopheles, however, the prospects for employing animals to divert them are apparently better and I have recently been told by Dr. Walch that domestic buffaloes were used to good advantage in controlling an epidemic of malaria in the Dutch East Indies.

The experiments of Caballero in Spain and others, showing that several species of algae of the genus chara were toxic to mosquito larvae, have been mentioned in the press quite frequently and the use of such a plant as a control agent in pools, ditches and water containers suggests interesting possibilities. One of the species, chara foetida, is common in certain parts of the United States but has not been reported as far south as Louisiana, I believe. In a recent review of the literature on this subject, Dr. L. O. Howard concludes that this species at least has been quite definitely shown to have a harmful effect on the larvae of certain mosquitoes (aedes and culex) although the larvae of anopheles are probably not affected. M. A. Barber found a species (chara robbinsii) growing abundantly in the rice fields in southern Louisiana and in testing its action found that it not only had no inhibiting effect on anopheles larvae, but formed an excellent

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*Report from Chairman of Sub-Committee on Entomological Research, National Malaria Committee (Conference on Malaria), meeting conjointly with Southern Medical Association, Eighteenth Annual Meeting, New Orleans, La., Nov. 24-27, 1924.

medium for rearing the larvae after it had decomposed. Aedes aegypti and culex quinquefasciatus also developed in the chara cultures. In our work at Mound we have found a species, identified as chara haitensis, in rice fields and have collected numerous specimens of culex and anopheles larvae in the shallow water directly over the mats of chara growth.

Nothing of especial importance in the way of new remedies has been brought out during the year, but a few interesting developments have been noted in the literature. Cresol as a larvicide, while not new, has again been used in at least two instances with good results. The Anti-malarial Commission in Palestine found it to be a promising larvicide in running water. A very weak solution acted as a trap, since it did not prevent oviposition but killed the larvae as they hatched. They reported that a dilution of one part in 10 million parts of water destroyed the newly hatched larvae and that as it was tasteless at this concentration it might possibly be of use in drinking water cisterns. Holden in Macedonia used cresol at the rate of one ounce to 100 cubic feet of water (about one part in 100,000) and also found that the advantage over oiling, in addition to the lower cost, was that it did not prevent oviposition in the treated water.

The use of gas as a larvicide in such places as wells, cisterns, etc., has been suggested and in a paper by K. B. Williamson some interesting results with various gases are described. He calls attention to the fact that a much lower concentration of a vapor is required to obtain the same toxic effect than with dissolved or floating poisons, and that insoluble gases cause no pollution of the water, and soluble ones only very slight. Chloropicrin proved to be the most effective substance which he tried and when vaporized continuously in the water container, would, without further attention, prevent mosquito breeding for a long period of time. The amount of chloropicrin required to maintain a sufficient concentration in still air was very insignificant.

In the way of biological investigations there are at present several organizations in the Southern states actively engaged on the complex problems of anopheles behavior and a number of instructive papers have been published.

My associate, Mr. Bradley, has recently published the results of several years observations on the natural breeding places of anopheles in the vicinity of Mound, La. In this paper is given a detailed description of the several types of breeding areas and a comparison of the plant growth and general environmental conditions which make a suitable habitat. This is a part of a general investigation of the food and other larval requirements. In other studies, using nets placed over the breeding places, he has determined the rate of emergence of adult anopheles per unit of area. From this we have been surprised at the extremely small production even where breeding was considered most favorable and our general impression gained from such observations is that in the presence of natural enemies and other limiting factors a very large breeding area is required to produce and maintain a large mosquito population.

Barber and Hayne in Arkansas found that the disappearance of anopheles from the daytime resting place took place within a few days; also that the mortality was very high when the mosquitoes were confined in a building corresponding to an occupied screened house. These results indicated that poorly screened houses are not apt to serve as a dangerous trap for infected mosquitoes and that infected mosquitoes do not tend to remain long about a single house. My own observations at Mound on the occurrence of infected mosquitoes point to the same conclusion.

The subject of attractants and repellants for mosquitoes is an interesting field of study and some new work has been done along this line, the most important of which is that of Rudolphs in New Jersey with the salt marsh mosquitoes. In testing their reaction toward certain chemical products of the human body, he concluded that perspiration, blood, urine and sebaceous secretions proved unattractive but that some of the intermediate decomposition products (phenylalanin and hemoglobin) were attractive and that several amino acids influenced their activity. Carbon dioxid and ammonia, ultimate decomposition products, were strongly activating and a combination of these with a proper degree of moisture and heat so as to reproduce the conditions of the breath was even more highly so.

In the way of repellents you are no doubt familiar with the work of Coogle with creosote oil. I understand that he is to give an account later in this meeting of the results of his recent control work in Mississippi.

In response to my request for a summary of the mosquito work in California, Professor Herms, as a member of the sub-committee, has sent the following statement:

"Several months absence on entomological investigations on several of the islands of the mid-Pacific ocean made it impossible for me to carry on my usual field work in California during the past summer. However, most of our mosquito work during the past year has been confined to laboratory studies. My associate, Professor S. B. Freeborn, has recently published his work on male terminalia in the *Journal of Hygiene*. This study of homologues of the terminalia of male mosquitoes has been accepted by many taxonomists. In his recent work in Massachusetts, Freeborn has also noted the overlapping of anopheles maculipennis and quadrimaculatus in that state. A manuscript on the 'Mosquitoes of California' is just about ready for publication. This will include an ecological and systematic treatment of the thirty species found in California.

"The past year has been exceedingly dry, as have been several previous years, with the result that mosquito breeding, particularly anopheles, has been in general much reduced.

"Observations have been made regarding wind blown anophelines. In some sections of the southern Sacramento Valley, known to be free of anophelines, it has been shown that heavy winds from the north may bring to these areas anopheles maculipennis from breeding areas at least five miles distant."

In connection with the above statement I may add that it has now been quite generally accepted by American entomologists that the California species of anopheles which has been known as occidentalis is identical with the common European species, anopheles maculipennis. Professor Herms mentions the fact that Dr. Freeborn had recently reported the occurrence of maculipennis in Massachusetts. Matheson and Shannon have recorded its occurrence in New York, Minnesota and Michigan and these records extend considerably the known range of this species in America.

Mr. Bruce Mayne, who is also a member of this subcommittee, has prepared the following outline of the studies on which he has been recently engaged, together with certain conclusions from his observations:

"(1) The influence of food and environment on the development of anophelines:

"I have found that anopheles quadrimaculatus can develop from egg stage to maturity when placed in macroscopically clear water (half tap and half river water) in the absence of vegetation.

"Recent desiccation studies have shown that the eggs of anopheles quadrimaculatus and crucians may withstand the action of atmosphere on dried mud—hatching after periods of at least three weeks.

"(2) Studies of the generations of anopheles crucians and anopheles quadrimaculatus:

"For this region (Southeastern Georgia) the attempt to determine the number of broods per season resulted in the conviction that there is a decided overlapping of generations.

"(3) Study of the malaria incidence and mosquito relations in Okefenoke Swamp, Georgia.

"This yielded the information, that malaria was absent among the swamp inhabitants; that the only species of anopheles present was crucians; that these mosquitoes entered houses and bit freely at all hours."

ENTOMOLOGICAL RESEARCH IN MALARIA*

By S. T. DARLING, M.D.,
International Health Board,
Leesburg, Ga.

It is a mistake to assume that the habits of anopheles are the same in all regions and that because in India a malaria-transmitting species has been found to breed in wells we should assume that the same is true in the Southern States and attempt to control anopheles breeding in wells on the assumption that they are a menace to health. A good many of the text books on malaria are compilations from the world's literature dealing with observations and experiences of workers in India, England, Italy or Panama, where the species of anopheles differ in their habits from those of the Southern States. One hears the statement made that borrow-pits are breeding places for malarial mosquitoes, but we now have records of observations made of borrow-pits in a number of places in South Georgia. Some of them were in the heart of a region of severe malaria, but the anopheles breeding in these borrow-pits was very scanty. The few larvae collected have been crucians with the exception of a few punctipennis in the cooler months, and on two occasions a few quadrimaculatus.

I do not wish to be understood as saying that borrow-pits are not a menace to health. I am merely concerned with their condition at present. All borrow-pits are not a menace. Whether they will become so and breed anopheles quadrimaculatus will depend on their age and proximity to habitations. A study of the limnology of borrow-pits shows that in the younger pits plankton is scanty and sometimes limited to diatomes and crustacea. Under these circumstances the pits do not support a rich anopheline fauna. When borrow-pits grow old and become filled with vegetation then, in the neighborhood of habitations, when other breeding places customarily used by quadrimaculatus have dried out this species may become implanted. Therefore, while all borrow-pits possess potentialities inimical to the public health, in our experience it has not been possible to incriminate them unreservedly as a malarial menace. Some discrimination therefore should be exercised in the destruction of borrow-pits when there are other real malarial problems in the neighborhood.

Illustrative of the tendency to borrow observations and generalizations from abroad and erroneously apply them to our conditions in the South is the well known statement that the malarial mosquito here can be recognized at a glance by its attitude when resting on the wall, this mosquito being said to rest with its body projecting outward from the wall at an angle of 45 degrees. Culex, on the other hand, is said to rest with the long axis of its body more nearly parallel with the wall. The truth of the matter is that anopheles quadrimaculatus, the malaria transmitter of the Southern States, has a culex-like attitude and when resting does not usually present the typical anopheline attitude seen in anopheles crucians and punctipennis.

We have therefore taken little or nothing for granted but have set out to ascertain if possible the nature of the malarial problems in our own locality.

Preferential Breeding Places.—Our observations tend to show that punctipennis is more apt to be found breeding in and near running water than in still water. On the other hand, anopheles crucians and quadrimaculatus seem to require water at rest. This is not only true of the immediate locality, but taking the state as a whole, the hill stream breeder is punctipennis, while quadrimaculatus is found in the flat land or in the hill country where water has come to rest in ponds, residual pools, swamps or limesinks. In the limesink country of Georgia it is not uncommon to find crucians and quadrimaculatus breeding in the same body of water, but there is a large area in southeastern Georgia, known

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as the Piney Flat Woods, in which crucians is almost exclusively to be found. While it is true that the three species are sometimes to be found breeding in the same collections of water very definite tendencies in the selection of breeding places has been noted and this matter is being pursued.

Some of the Reaction of Hydrogen-ion Concentration of Waters.—Not only have the three species been found to disclose preference for the selection of breeding places of certain types, but an investigation of the hydrion concentration of these waters has shown that the larger proportion of crucians is taken from waters which are sub-acid or minim-acid. The larger proportion of punctipennis is found not in acid water but in waters which are very slightly alkalin. On the other hand, most quadrimaculatus are found in waters more nearly neutral than the other two species.

Limnological Studies.—During the past summer the plankton of breeding water was studied by Mr. Lowell T. Coggeshall, whose studies indicated that punctipennis was oftener found in waters relatively scanty in plankton when compared with waters in which quadrimaculatus was found. When the running water of streams was brought to rest in residual pools through lack of rain, the plankton increased in amount. When this occurred quadrimaculatus might then become implanted. This last species was found in greater numbers at a period when chlorophyceae were more abundant. From those borrow-pits, limesinks, or swamps in which there was little or no anopheles breeding there was a correlated absence of the types of plankton found abundantly where anopheles breeding was present or prolific.

Meterological: Rainfall and Drought.—Interesting records of the density of the three species of anopheles have been made comparing the year 1923, when through the distribution of rainfall there was high ground water, with 1924, when during the latter half of the summer drought conditions and low ground water level prevailed throughout the region. With the disappearance of quadrimaculatus breeding places in 1924 there was a corresponding diminution in the numbers of anopheles and the amount of malaria and blackwater fever.

The relation of air and water temperatures to the density of larvae and adults of the three species has been traced. Crucians appears in largest numbers in the spring months of March, April, May and June, rapidly diminishing in July and then more slowly and steadily diminishing in numbers toward the end of the year. Punctipennis appears throughout the year, adults increasing somewhat in numbers in the cooler months of spring and fall. From an epidemiological standpoint quadrimaculatus is the one species the density of which is positively correlated with the prevalence or intensity of malaria.

Effect of Cold.—Observations on the effect of cold and of freezing temperatures have been interesting and of some practical value, perhaps the most important being the effect of cold on the mosquito larvae. When the temperature of water is reduced to well below 60° F., larvae leave the surface for the bottom of the water rising to the surface when the temperature again becomes elevated. During the winter months when temperatures of the water range from 39° to 50° F., larvae spend most of their time on the bottom, in a quiescent state. If they are disturbed they may return to the surface, or nearly to the surface, for a few seconds, usually dropping to the bottom and remaining there. This observation has some practical importance because when searching for breeding places during the cooler months the bottom must be well disturbed so as to bring larvae when present, to the surface.

Resting Places of Adult Anopheles.—The location in which a blooded anopheles is found is only presumptive evidence that she acquired the blood meal in the habitation, stable, or fowl-house in question, and occasionally this evidence may be erroneous, for dissections of quadrimaculatus caught in a fowl-house have revealed mammalian erthyrocytes in the mosquitoes' stomachs.

In making malarial inspections it is important to know where to look for adult mosquitoes. This subject has been thoroughly pursued, by searching for every possible type of resting place in the locality inside and under houses, behind beds and wardrobes, on beams and rafters, in outbuildings of different types, under culverts, bridges, tree trunks, hollow trees, roadsides and elsewhere. The influence of sunlight and of wind in making mosquitoes seek places of shelter on the windward or leeward side of rafters or chimneys has been noted.

Observations on the relative number of males and females caught in various locations in relation to distance from breeding place have been made. It appears that during the warmer months the relative number of males to females diminish directly with the distance from the breeding place, and this has been found helpful in the search for anopheles breeding places.

In general male mosquitoes are found in greatest numbers close to the breeding place, as under bridges (punctipennis) under culverts, (crucians) and in tree holes (quadrimaculatus). In these locations 50 per cent and sometimes more of the mosquitoes will be found to be males. Mating probably occurs near these locations but may possibly take place farther away, for male quadrimaculatus have been found three-fourths of a mile from their sole breeding place. The great majority of males however were found within less than one-fourth of a mile of the breeding area.

Traps.—Traps and index boards have been used for the detection of the presence of anopheles near breeding places and for information in regard to feeding habits.

Feeding Habits.—The feeding habits of the three species have been investigated by means of the precipitin test with results in keeping with those already ascertained for quadrimaculatus by King and Bull. Crucians show very marked tendency to feed on animals rather than man. Among 236 crucians 157 fed on cow, 33 on pig, 30 on horse, 11 on dog, 2 on chicken, and only 3 on man.

Among 272 quadrimaculatus 88 had fed on man, of the remainder 130 had fed on cow, 41 on pig, 7 on horse, 4 on dog, and 2 on chicken.

All of ten punctipennis tested from which valid data were obtained had fed on animals and none on man.

Interesting confirmatory observations were made by trapping mosquitoes that had entered screened houses by coming down the chimneys. These traps were placed in the fireplace in such a way that the day's catch could be removed and counted. As many as 150 adult anopheles were obtained from one fireplace during two days. The mosquitoes were always anopheles quadrimaculatus and were usually unfed virgins.

An analysis of catches made from our collecting stations in which adult female anopheles are taken from a variety of places indicates that quadrimaculatus is to be found inside and under houses. Crucians is found under houses, under culverts, and in outbuildings but rarely or never inside habitations. Punctipennis is found in animal sheds, outbuildings, under bridges and under trees or other sheltered places out of doors. Quadrimaculatus therefore apparently discloses a closer relationship with man while crucians and punctipennis are oftener found in more apparent relationship with animals. Punctipennis while preferring animal blood will attack man when he visits the resting places of this species in the woods, particularly near streams. Quadrimaculatus is distinctly fond of human blood and is commonly found to enter houses at night through windows or doors or chimneys.

Infectivity Rate of Wild Mosquitoes.—It may be recorded, as bearing on the feeding habits of the three species of anopheles and in relation to their efficiency as transmitters of malaria, that 2,179 anopheles were dissected in 1923, from May to October inclusive. Of this number 77 punctipennis, 571 crucians, and 1,471 quadrimaculatus were negative for malarial plasmodia, either in stomach or gland, while 60 specimens of anopheles quadrimaculatus or 3.9 per cent of the number of this species examined contained malarial plasmodia in either the stomach or glands.

Flight Experiments.—Flight experiments were made to determine the source of the quadrimaculatus visiting a certain community. The fight, as noted by several observers, occurred at a certain moment about dusk. This was preceded by a movement of bats toward the mosquito breeding place. Mosquitoes stained by a dusting powder were later collected at several locations inside and under houses and in outbuildings in the community in question. A dusting powder was found to give better results than a liquid for staining mosquitoes.

Dispersion of Mosquitoes.—The dispersion of quadrimaculatus from a large breeding area into a sparsely populated and scattered community was studied, for the purpose of ascertaining the approximate limits within which malarial control would be required. Most of the mosquitoes were found within three-fourths of a mile of the breeding place, very few had traveled as far as one and one-half to one and three-fourths miles. None was found beyond this.

Egg Laying Habit.—A blood meal appears to be absolutely necessary for the anopheles mosquito before there can be any development of ova beyond a primordial stage. After the ingestion of a meal, digestion of the blood proceeds in an orderly manner, usually being completed in about 48 hours in warm weather or in three or more days in cold weather. There is a simultaneous development or maturation of the ovum. Observations have been made on these two processes, digestive and ovulatory, for the purpose of ascertaining how long it takes a mosquito to mature her ova after a blood meal and to ascertain how long she remains in the place or near the place where the blood meal was obtained, also to learn where she rests after that period and for how long a period. These observations are uncompleted but it may be stated that quadrimaculatus may remain but a day or two within a habitation after obtaining a blood meal. She then leaves the habitation for another resting place. This may be near the breeding place or some point intermediate to it. Eggs may not be laid for several days after the blood meal. The eggs may be laid at one time or on two successive days. Sometimes one or more eggs remain in the oviduct after oviposition. Upon dissection of such a mosquito later these eggs are an indication that the mosquito has already laid one batch of eggs. From these and other studies it has been elicited that a mosquito usually completes a feeding upon one person and does not remain in the house for more than a day or two afterwards. Two practical points emerge from this, first, that an infected anopheline probably does not feed upon more than one person, and does not therefore, convey infection to more than one person at the time of obtaining a blood meal. An infected anopheline therefore will not infect a large number of persons at one time as has been suggested. Second, as anopheles which have entered a house during the night and fed upon the inmates remove from the building after two days or so and their places are taken on successive nights by successive lots of anopheles, then, if it is desired to fumigate houses for the destruction of infected mosquitoes it will be necessary to fumigate every other day or two, otherwise mosquitoes which had become infected will have left the house without being destroyed. House fumigation therefore is probably an impracticable measure.

Identification of the Species of Anopheles by the Anatomical Character of the Larvae.—The ability to make immediate diagnosis of the species of anopheles larvae enables the malariologist to incriminate a breeding place without the delay usually attendant upon the breeding out of adult from larvae. Such information was of value in Panama and in the Orient where all species of anopheles were not efficient transmitters of malaria. If, as there appears to be, but one vector of malaria in the Southern States and that species as she appears to do, exercises preferences in her breeding places then an immediate diagnosis of the species from

the larval characters will be a valuable aid to malarial workers.

Dr. Paul F. Russell, working in this Station, has determined a number of the specific anatomical characters of the larvae of the three species of anopheles and has devised a key which enables us positively to differentiate the species of anopheles of this region from the fourth stage larvae.

Key.—(1) Abdominal segments 4 and 5 have both a dorsal sub-marginal hair and an antepalmate hair—*A. crucians.*

Abdominal segments 4 and 5 have an antepalmate hair but no dorsal sub-marginal hair—2.

(2) Anterior internal clypeal hairs close together at base—*A. punctipennis.*

Anterior internal clypeal hairs well separated at base—*A. quadrimaculatus.*

MALARIA STATISTICS*

By KENNETH F. MAXCY, M.D.,
Surgeon, U.S.P.H.S.,
Montgomery, Ala.,
and
WILSON G. SMILLIE, M.D.,
International Health Board,
Andalusia, Ala.,
and
W. A. PLECKER, M.D.,
Registrar of Vital Statistics, Virginia State Board of Health,
Richmond, Va.

Your sub-committee on statistics accepts the hypothesis that its primary and most important function is to promote a more accurate understanding of the distribution and relative intensity of malaria infection in different parts of the South. It is futile to attempt to correlate malaria prevalence with various social, economic and geographic factors until the limited localization of the disease is well understood, and its prevalence determined with some degree of accuracy. Information along these lines is at present meager and crude. There is a general tendency grossly to exaggerate the situation, with resulting economic injury to certain sections. An effort to correct this situation and to present the truth is evidently an important part of any program, state or local, directed against the disease.

The source of all error in this regard is the looseness with which the term "malaria" is used by physicians and by people throughout the South to denote any ill-defined feeling of lassitude, any minor illness, or any fever of undetermined cause. Every public health official who is interested in the malaria problem of the South should take careful thought as to ways and means of educating the profession and the public to a more accurate conception of the disease "malaria." Too often the tendency is in the opposite direction. In order to put over a program the public health official exploits the ignorance of the public to convince them that the disease is a public health problem where it is not. In order to satisfy the family of the patient when the diagnosis is unknown, the case is labelled "malaria."

Accurate information regarding the problem will become available only when every Southern state health officer has assigned to one of his assistants the duty of collecting, compiling and presenting data regarding malaria prevalence with such uniformity of plan as may render it comparable with similar data from other states. This committee should act as a clearing house to promote the use of uniform methods, to summarize current knowledge regarding the problem in each state, and to make this information available in such form as can be distributed to interested agencies, philanthropic, educational, commercial, etc.

EPIDEMIOLOGICAL CONCEPTS

In a recent article,[1] it has been pointed out that malaria is not generally distributed in any state, and, indeed, in very few counties in the South. It exists in limited localities or foci. For the sake of uniformity, it is suggested that the terms (a) endemic, (b) epidemic, and (c) potential foci be used as defined in this article to classify and describe the type of prevalence.

(1) *Reconnaissance Information.*—From the point of view of the public health administrator the available sources of reconnaissance information regarding malaria prevalence in a state or county are chiefly:

(a) Mortality Statistics.

(b) Morbidity Statistics.

(c) Laboratory Examinations.

No one source should be depended upon exclusively. Evidence from each of the three should be utilized in locating the areas in which the disease customarily prevails.

(*a*) *Malaria Mortality Statistics.*—The relative inaccuracy of malaria mortality statistics has been sufficiently emphasized. On the other hand, none will deny the value of this index were it made reasonably accurate. Whether desired or not, the relative incidence of malaria in the Southern states will probably be measured largely by mortality rates for some time to come. Every state health administrator should therefore be vitally interested in seeing that his own state does not receive undeserved and undesirable notoriety in this regard.

For example, in the State of Alabama during the years 1922-1923 an attempt was made to ascertain the size of the error by sending a special inquiry to every physician signing a certificate of death as due to malaria. The results of this inquiry are presented in Table 1.

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On the basis of this experience, it is estimated that probably not more than one-half of the deaths attributed to malaria in Alabama should properly be so charged. This condition of affairs is probably not essentially different in the other Southern States.

Classification	1922 Number	1922 Per Cent	1923 Number	1923 Per Cent
Confirmed by blood examination	13	6	20	12
Clinically positive only	106	48	69	41
Clinically doubtful	53	24	47	28
No physician	18	8	21	12
Erroneous entry	31	14	12	7
Malaria Deaths—checked	221	70	169	66
Malaria Deaths—recorded	304	100	255	100

Table 1.—Analysis of Malaria Death Certificates, State of Alabama, based on inquiry sent to physician signing certificate.

Beside the primary error made by the physician in assigning the cause of death, there are also errors inherent in the methods of collecting vital statistics. This is best illustrated in the case of South Carolina. In many of the coastal counties where the malaria problem is most severe, there is a lack of adequate medical attention. A very large proportion of the deaths which occur are in negroes unattended by a physician. In these cases, instead of being content to enter the death as due to 205-a "Cause ill-defined or undetermined," the state registrar, working under direction of the Census Bureau at Washington, encourages, in fact insists upon, the local registrars (persons usually with no medical knowledge whatever) entering upon the certificate the probable cause of death. That "malaria" is a very popular and satisfactory term to them is attested to by the results presented in Table 2. While only 11 per cent of the typhoid and 17 per cent of the tuberculosis deaths in this state are uncertified by physicians, 50 per cent of the deaths entered as malaria are diagnosed by the local registrars.

Cause of Death	Per cent of total deaths attributed to this cause not certified by a physician. Total	White	Colr'd
1. Typhoid and paratyphoid fever	11.2	6.4	13.7
5. Malaria	50.1	13.6	57.6
43–49. Cancer	7.5	4.4	12.6
31–37. Tuberculosis	17.1	4.8	20.9
101. Pneumonia	32.5	17.4	41.7
129. Chronic nephritis	8.0	4.0	11.6

Table 2.—Comparison of several important causes of death in regard to the proportion of certificates uncertified by a physician,—South Carolina experience,—for "Mortality Statistics," U. S. Census, 1921, Table CG, pp. 100-107.

As a result, two counties, Beaufort and Berkeley, had the highest death rate from malaria of any counties in the United States during 1923. Of the 42 deaths attributed to malaria in Beaufort County, not a single one was certified by a physician. Of the 53 deaths in Berkeley, only 4 were certified by physicians.

That this policy of insisting too strongly on a diagnosis from the local registrar is wrong and injurious to the state is obvious. It vitiates the value of the whole system of statistics coming from this state. It would be much better were a greater proportion of the death certificates classified under 205-a "Cause, ill-defined or undetermined," than that they should be entered fallaciously as "malaria." It is interesting to observe in this connection that in spite of the large rural population in South Carolina with inadequate medical attention only 3 per cent of its certificates are classified as "cause undetermined," whereas in North Carolina 8 per cent, and in Mississippi 9 per cent are so classified.

Realizing then that the accuracy of malaria death certificates can be considerably improved, it is still possible to obtain valuable reconnaissance information from them. The results of two such analyses (2, 3) have been published in the Public Health Reports.

(*b*) *Morbidity Statistics.*—Up to the present, little use has been made of malaria morbidity reports in the Southern States. They have been considered of little value because:

(1) Physicians see only a small proportion of malaria cases.

(2) Of those seen by physicians only a small proportion are reported.

(3) Of those that are reported in many instances the diagnosis is inaccurate.

All of these objections apply, if one attempts to use morbidity reports of malaria alone, as an index of prevalence.

On the other hand, it is to be pointed out that malaria morbidity reports can be made a valuable source of information in localizing the malaria problem, if they are treated with due regard for the errors involved. The report of a case of malaria by a physician should be treated as a notification that the physician thinks malaria is occurring in a certain locality. If this report is repeated and is confirmed by reports of other physicians of cases in the same locality, then the likelihood that a malaria problem exists in this locality is correspondingly great. It is the duty of the local or state health official to establish and extend this knowledge by a field study.

This use of malaria "notification" naturally requires that each case be reported by name and address. It is questionable whether reports by physicians of simply the number of cases of malaria they have seen during a given period are of any value whatever.

(*c*) *Laboratory Examinations for Malaria.*—The examination of blood smears for malaria parasites for physicians by public health laboratories is the most potent single influence tending to correct the exaggerated idea of the prevalence of this disease. Not only are many physicians themselves brought to be more careful in their use of the term "malaria," but through them their patients are being educated. The volume of the work in the several Southern States is indicated in the accompanying Table 3. Where 7000 or more examinations for malaria parasites are being made each year the effect in more properly restricting the diagnosis cannot be questioned.

Aside from this very great service which the public health laboratories are performing, their records are often of considerable value as a source of information regarding prevalence. For example, the occurrence of an epidemic of malaria may first be ascertained through

following up the origin of positive malaria slides. Endemic foci may be spotted by the regularity with which slides from a given locality are found positive. If an active and well equipped laboratory in a city of some 200,000 examines 600 to 800 slides annually for physicians with an average of 16 to 20 positive reports, it is improbable that there can be a serious malaria problem in this vicinity.

State	Number of blood smears examined for malaria in public health laboratories.
Alabama	3,734
Arkansas	1,656
Florida	6,604
Georgia	1,463
Louisiana	713
Mississippi	6,816
Tennessee (Memphis)	2,041
Virginia	578
South Carolina	537

Table 3.—Comparison of several Southern States, based on laboratory examinations made in 1922.

(2) *Detailed Information.*—It should be the aim of every administrator to work from the general to the specific, from the approximate to the exact. As money and personnel allow, field studies should be conducted in each county indicated by the reconnaissance information to more definitely locate, delimit and measure the malaria problem. Whether the school, the plantation or the individual home is chosen as the unit the methods utilized in field surveys may be reduced to three, viz.:

(a) History index.

(b) Spleen index.

(c) Blood index.

The function of this sub-committee in this regard is to secure uniformity, so far as is practicable, in the expression of results, so that the data collected may be comparable, one state with another, and one county with another.

(*a*) *History Index.*—This is, of course, the most readily available and most commonly used method in the field. The generally used definition of what constitutes "positive" malaria history does not seem to go into detail further than "any clear account of chills and fever every day or every other day." Where the disease is commonly prevalent, the population is well acquainted with the term "chills and fever" and the relative prevalence of the disease may be rapidly estimated by the history index. On the other hand, where the history rate is low (less than 10 per cent) and the clinical histories are somewhat vague, it is difficult or impossible by this method alone to decide whether there is a low endemicity, imported cases only, or no malaria whatever in the locality. Recourse must be had to the more exact methods, spleen and blood examinations, and the period of observation must be prolonged. Under any circumstances, reliance must be placed in the latter methods for anything approaching an exact numerical statement of the amount of malaria in a given locality.

(*b*) *Spleen Index.*—For the sake of uniformity in procedure in spleen examinations, the committee recommends the following conditions:

(1) Examinations limited to children between 2 and 12 years of age, sex, race, and time of year to be specified.

(2) Examinations made with subject reclining, knees drawn up and abdomen relaxed.

(3) Spleens called positive whenever the edge can be definitely and unmistakably felt descending with inspiration.

Owing to the fact that the spleen rates are low in most sections of this country, it is doubtful whether it is worth while to classify the enlarged spleens according to size, except as a matter of individual or scientific interest.

(*c*) *Blood Index.*—For the sake of uniformity, it is suggested that when a blood index is taken the following conditions be observed:

(1) Age, sex and race and time of year distribution to be specified.

(2) Thick smear technic to be used.

(3) Examinations to be made only by laboratory workers especially trained and fully experienced in the use of thick smear technic.

(4) Five minutes search of each slide the basis for a "negative."

It has been hoped that some constant relationship could be demonstrated between the different indices. So far this has not been realized. It is suggested, however, that where both bloods and spleens are done on all persons of a given group, the so-called "endemic index" may be found useful. This index is here defined as the relation of the number of individuals with either positive blood or spleen, or both, to the total number of individuals examined.

RECOMMENDATIONS

To further and make available more accurate knowledge concerning the distribution of malaria your committee recommends:

(a) That the state health officer of every Southern state in which there is a malaria problem be requested to make one of his assistants (preferably the epidemiologist or malariologist) responsible for assembling the information on malaria prevalence for his state.

(b) That such assistant be made ex-officio a member of the sub-committee on statistics of the National Malaria Committee.

(c) That each member of this committee submit annually a report and a graphic presentation of the current knowledge concerning the distribution of the problem in his state.

(d) That the members of the committee work out standard methods of procedure so that the data from all of the states may be expressed on approximately the same basis.

(e) That provision be made by the National Malaria Committee for making available the results of these studies to interested parties.

(f) That the Sub-Committee on Statistics call the attention of the U. S. Bureau of the Census to the inaccuracies peculiar to the registration of deaths from

malaria, and assist the various state registrars to secure more accurate registration.

(g) That the necessity for taking definite measures to combat professional and popular misconception of the diagnosis "malaria" be brought to the attention of all state health officers concerned and the importance of this phase of the campaign against malaria be emphasized.

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ENGINEERING IN MALARIA*

By J. A. LePRINCE,
Senior Sanitary Engineer, U. S. P. H. S.,
Memphis, Tenn.

Your Committee took up with the State Sanitary Engineers and State Health Departments the question of improper road culvert installation, improper location and grading of borrow-pits, and of insanitary roadside ditches. A copy of the letter sent to 45 states is attached to this report. Our letter which requested replies to nine questions has resulted in considerable increased activity in the way of mosquito elimination by drainage along highways in a number of states, and many county highway engineers have written to the state health officials thanking them for bringing this matter up and also offering their hearty support. The state sanitary engineers have in many instances taken this matter up with the county highway commissioners, who in turn are showing interest and doing more and better drainage. Some of the state highway engineers have issued instructions to their assistant engineers to pay special attention to drainage from the standpoint of eradication of the mosquito.

Our plan is to get a large number of county engineers interested in mosquito control drainage.

An attempt was made to get some of the chief engineers and general managers of the railroads traversing the malaria belt to attend the Conference of the Malaria Field Workers at New Orleans on November 25 and 26, but the program was too crowded to devote the time to prevention of malaria by railroads that the subject deserves.

An article has been prepared and accepted for publication in one of our Government road engineering magazines that has a large circulation among engineers and contractors, and others interested or engaged in highway construction.

Another paper entitled "What the Engineer Can and Should Do for Mosquito Control and Malaria Control" is being published in two technical journals, and an abstract of it entitled "Responsibility of Engineers and Contractors for Malaria and Mosquito Nuisances" will appear at an early date in "The American City Magazine."

*Report of Sub-Committee on Engineering, National Malaria Committee (Conference on Malaria), meeting conjointly with Southern Medical Association, Eighteenth Annual Meeting, New Orleans, La., Nov. 24-27, 1924.

DISCUSSION ON RELATIVE IMPORTANCE IN TRANSMITTING MALARIA OF ANOPHELES QUADRIMACULATUS, PUNCTIPENNIS, AND CRUCIANS AND ADVISABILITY OF DIFFERENTIATING BETWEEN THESE SPECIES IN APPLYING CONTROL MEASURES*

By S. T. DARLING, M.D.,
International Health Board,
Leesburg, Ga.

When I came South early in 1923 to study malaria I noticed that there was a tendency among the malarial workers with whom I conversed to speak of anopheles mosquitoes and anopheles breeding places without regard to species.

In literature on malaria in the South references were made to anopheles breeding places instead of specifying that they were the breeding places of quadrimaculatus, punctipennis, or crucians. It was also explicitly stated that all three species had been proven to be transmitters of malaria (Sweet) although the opinion was encountered in conversation as well as in the literature (Komp) that of the three species quadrimaculatus was the most effective carrier.

The opinion held as to the relative importance of the three species in malaria transmission is based on the incriminating experiments of King and Mayne, by the results of the dissections of wild mosquitoes by King, Mayne and Metz, and on the epidemiological observations of Carter and Fisher.

King and Mayne determined that each one of the three species could be infected experimentally.

The evidence which we possess that quadrimaculatus can be naturally infected is derived from the work of King, Mayne and Metz.

There is only one recorded instance in the literature of the finding of a naturally infected specimen of punctipennis. This was found by Mayne in September, 1916, from Talladega Springs, Ala.

With regard to crucians Mayne (Mitzmain) found in the malarial village of Lenwill, northern Louisiana, one

*Read before National Malaria Committee (Conference on Malaria), meeting conjointly with Southern Medical Association, Eighteenth Annual Meeting, New Orleans, La., Nov. 24-27, 1924.

RESULTS OF DISSECTIONS IN 1923

	A. punctipennis		A. crucians		A. quadrimaculatus		
	No. Dis.	No. Pos.	No. Dis.	No. Pos.	No. Dis.	No. Pos.	Totals
May	5	0	43	0	3	0	51
June	19	0	45	0	27	0	91
July	8	0	45	0	118	3	171
August	22	0	219	0	391	20	632
September	13	0	125	0	302	10	440
October	9	0	30	0	261	13	300
Totals	76	0	507	0	1102	46	1685
Dr. Root's dissections	1	0	64	0	429	14	494
Grand Totals	77	0	571	0	1531	60	2179

Percentage of 1531 A. quadrimaculatus dissected—positive 3.9 per cent.
Percentage of 571 A. crucians dissected—positive 0.0 per cent.
Percentage of 77 A. punctipennis dissected—positive 0.0 per cent.

specimen of crucians out of twenty examined to have sporozoites in the salivary gland. At the same time, (August 23-November 25, 1917) 2.4 per cent of 709 quadrimaculatus were also found to be infected naturally. Metz examined 379 specimens of crucians from the neighborhood of Lakeland, Fla. Two, or 0.5 per cent, were found infected. At the same time 423 specimens of anopheles quadrimaculatus caught in the same neighborhood yielded an infection rate of 0.9 per cent.

Epidemiological testimony for the incrimination of crucians was submitted by Beyer and his colleagues, but this was not regarded as good evidence by King (I have not yet consulted the papers in question). The epidemiological evidence in the case of anopheles quadrimaculatus as being an effective carrier in the transmission of malaria is complete and sound and tallies with the evidence derived from the dissection of mosquitoes.

Malaria, according to Dr. Henry R. Carter, has never been found prevalent where anopheles punctipennis alone has been found breeding.

Fisher believes that punctipennis may have been responsible for malaria at Chester, S. C., 1919, because the topography is typically the kind in which punctipennis occurs and that was the only species found, and "was producing freely close to houses." In these observations of Fisher's it is stated that the topography of the country near Chester, with its streams deeply eroding the red clay of the Piedmont Plateau, is typical of the kind in which punctipennis occurs, but while he is careful to note that no ponds occur in the section except about four miles east of the town he states "that during low water stages the stream beds contain eroded depressions in which water is retained, forming favorable mosquito breeding places."

Now our observations go to show that when regular visits at short intervals and collections are made in such residual pools as form in these eroded depressions, quadrimaculatus will occasionally be found, for this species tends to become implanted in the still water of the pools, disappearing when the water current of the stream is restored. Sometimes the two species coexist for a short time in these residual pools, but it has taken careful weekly inspections of such streams and pools to gather this important piece of information. It is possible therefore that there may have been some quadrimaculatus breeding in the residual pools at Chester.

Beside the view that all three species of anopheles are to be regarded as transmitters of malaria there was an opinion held, naturally enough under the circumstances, that all anopheles breeding places were equally a menace from a public health standpoint and that all required attention in order to control malaria.

We know quite well from the investigations made in other countries that all anopheles of a region are not equally hospitable to experimental infection and all are not found equally infected in nature.

In Panama when anopheles malefactor was fed, in jars with anopheles albimanus, on patients from which 70 per cent of the albimanus became infected, anopheles malefactor failed to become infected under the circumstances. This mosquito which failed in its susceptibility to malarial infection was found also to have breeding habits different from anopheles albimanus the malaria carrier, for malefactor was a sylvan species. Another species encountered in Panama was anopheles pseudopunctipennis. Only 4 out of 31 mosquitoes (13 per cent) under the most favorable experimental conditions became infected, and this mosquito, relatively inhospitable to malaria infection, also possessed habits different from those of the malaria carrier, for punctipennis was rarely or never taken in quarters and its breeding places were often encountered two miles or more beyond human habitations.

From the dissection of anopheles mosquitoes and observation of their habits I have learned that sometimes anopheles which are reputed to be efficient transmitters of malaria feed on animals as well as on man. The evidence therefore required to incriminate a species as being an effective transmitter of malaria should include the natural infectivity rate of wild specimens of this species collected in regions of severe malaria where the species normally breed and naturally by preference feed on man or animals. Should the evidence fail to incriminate the species then testimony should be elicited dealing with the habits of the species tending to show why it did not become infected, evidence, for example, that it preferred the blood of animals to that of man.

In determining the relative importance of the different species of anopheles as vectors of malaria it is essential that a number of human malarial carriers be present at a time when the mosquitoes are breeding in order that an infectivity rate may be determined without the dissection of an inordinate number of specimens, that is to say, the information should be

forthcoming from the dissection of 500 specimens or less. In selecting Lee County, Georgia, as a place to establish a station for the study of malaria, a district was found where the malaria was severe and where three species of anopheles were to be found during the seasons.

The Infectivity Rate of the Three Species in Lee County, Georgia.—The mosquitoes dissected in this series were collected from a wide variety of situations, and all of them in the neighborhood of habitations where spleen rates ranged from 8 to 100 per cent. Most of them were taken at a time when spleen rates were 40 per cent or over and also where spleen rates of from 30 to 50 per cent were to be found during the winter and spring of 1923-1924. Spleen rates are always 50 to 75 per cent higher than blood rates. No matter what the season, whether winter or early fall, gamete carriers were always available for the infection of anopheles species seeking a blood meal from man. In many instances when the mosquitoes were collected for dissection, the spleen and blood rates of the children were obtained at the same time. In this way some definite information was obtained for the correlation of mosquito infectivity rates with the spleen and parasite rates, and an attempt was made to avoid the source of error likely to occur when mosquito vectors are searched for in a region where the malarial rate of each mosquito collecting place is not known.

A number of the specimens of crucians dissected, 166 in all, were taken under or inside houses or in other locations in which quadrimaculatus, some of them infected, were taken at the same time.

Discussion of the Results of the Dissections.—The infection rates of quadrimaculatus taken from different locations range from 2 to 5 per cent during the warm months of the year. The rate for the entire summer from May to October inclusive, was 3.9 per cent. During the same period not a single crucians was found to be infected, although they were usually taken under houses where infected quadrimaculatus were found at some time during the summer. This negative evidence against crucians is all the stronger because the species was usually found along with quadrimaculatus.

It is regrettable that the negative evidence against punctipennis is still incomplete. This is partly due to the circumstance that adult punctipennis are not very abundant during the malarial season and are not found in locations so close to man as is the case with quadrimaculatus and crucians. This species is found in large numbers in the streams of the Piedmont Plateau and elsewhere, but curiously enough malaria is less common or absent in these localities. Punctipennis was rarely taken inside and under houses where quadrimaculatus and crucians were constantly found. They were found rather in outbuildings, roadsides, under bridges and in woods near the streams in which they bred and in places where presumptively they had acquired a blood meal from animals rather than from man.

The information which we elicited positively incriminates quadrimaculatus as being a carrier of malaria and the sole carrier of malaria in the region under consideration.

With regard to crucians and punctipennis not a single specimen as yet has been found infected. The evidence with regard to crucians, while of a negative character, is conclusive enough for practical purposes. More work will need to be done with anopheles punctipennis.

Preferential Feeding Habits of Anopheles Crucians, Punctipennis and Quadrimaculatus.—Noting that the two first mentioned species were rarely found feeding on man and never to the extent observed with anopheles quadrimaculatus, the proved effective transmitter of malaria, it was desired to ascertain the origin of the blood meal in specimens of these two species by the precipitin test. The tests were carried out by Dr. Bull in his laboratory in Baltimore, and the very marked preference for animal blood of anopheles crucians and punctipennis was disclosed.

Our data in regard to this question is being added to, particularly with reference to anopheles punctipennis. It is noteworthy that of 79 blooded specimens of punctipennis tested by King and Bull, none had fed on man, but all were found to react to the anti-serum of the horse, cow, pig, or dog.

The precipitin test revealing, as it does, the preference of crucians and punctipennis for animal blood to that of man, shows us why these two species, although susceptible to infection experimentally, do not become so naturally, and why they should probably not be regarded as efficient carriers of malaria.

The Correlation Between Malaria Prevalence and the Seasonal Density of the Three Species of Anopheles.—When the incidence of malaria as determined by spleen, blood rate, or by histories is compared with the density of the three species of mosquitoes at several periods of the year, it is seen that when quadrimaculatus is found in greater numbers, the malaria correspondingly increases, while at the same time crucians and punctipennis diminish in numbers, for quadrimaculatus is a mosquito preferring warm weather, while crucians and punctipennis are found in greatest numbers in the cooler months when the incidence and severity of malaria are at their lowest points.

Other Epidemiological Testimony.—A comparison of the geographical distribution of malaria with the distribution of anopheles mosquitoes in places which I have studied, discloses the fact that malaria is found where quadrimaculatus and quadrimaculatus breeding places are abundant, and that malaria is sparse or absent where this mosquito and its breeding places are infrequent or absent.

In the regions of the South where hill streams are exclusively the type of water collections found and where streams are not impounded, and where there is no standing water in limesinks, there is little or no malaria. In these places where water is in motion punctipennis is the prevailing species. When, however, the water in the streams is brought to rest as in the residual pools which are formed in the bed of the river during late summer, or by the impounding of a stream,

ORIGIN OF BLOOD MEAL OF ANOPHELES MOSQUITOES DETERMINED BY THE PRECIPITIN TEST

	Man	Horse	Cow	Pig	Dog	Chicken	Total
Quadrimaculatus	88	7	130	41	4	2	272
Crucians	3	30	157	33	11	2	236
Punctipennis	0	0	8	1	1	0	10
Total	91	37	295	75	16	4	518

quadrimaculatus may become implanted and malaria break out.

In the regions where malaria is prevalent and at the time when it is prevalent, neither crucians nor punctipennis is the species exclusively to be found.

There are large areas in southeastern Georgia where anopheles crucians is almost exclusively to be found and in these regions malaria is infrequent or entirely absent.

A striking bit of testimony may be presented tending to show that malaria is more prevalent in places where there is still water favorable for the breeding of anopheles quadrimaculatus than in places where there is running water in which punctipennis abounds, or again, in the wet piney flat woods of southeastern Georgia where crucians is almost exclusively to be found.

The state of Georgia may be divided with reference to certain topographical and geological formations into about seven regions. Each region has a characteristic surface formation and each region yields a characteristic history in regard to the severity of the malaria encountered therein.

Regions 1 and 3, the Cumberland Plateau and Appalachian Mountains, are mountains with falls and rapidly running streams in which type of water punctipennis breeds but in which quadrimaculatus is not usually encountered. No fatal cases of malaria are reported from these regions.

Region 2 is the Appalachian Valley. In these valleys, although punctipennis is the predominant species, anopheles quadrimaculatus must find a few acceptable breeding places in the flat lands, for a few deaths from malaria are reported annually.

Region 4 is the Piedmont Plateau, a rolling country throughout with characteristic red clay eroded by the streams. Punctipennis is the predominant species excepting in places and at times when water has been brought to rest and becomes favorable for the breeding of quadrimaculatus. There is some scattered malaria in this region.

Region 6, the piney flat woods region, is relatively free from severe malaria. Here, so far as our investigations have gone, punctipennis is absent, crucians is the predominating species, but quadrimaculatus occurs in places.

No. 5, A and B, and 7, represent a peculiar limestone formation in which the "limesinks" occur in large numbers. These sinks are formed by the corrosion of the subterranean limestone strata. The falling in of the superincumbent layers of soil has formed basins and bowl-like depressions often containing standing water, in which quadrimaculatus will breed if habitations are within reach. These are preeminently the malaria regions of Georgia, and although punctipennis and crucians are found breeding in various waters, quadrimaculatus is found in these regions in much larger numbers than in any other area of Georgia, so far as our investigation has disclosed.

Conclusions so far, from my own investigations, are that quadrimaculatus is probably the only effective transmitter of malaria. This is because of the high rate of natural infectability and its demonstrated fondness for the blood of man. Crucians and punctipennis for practical purposes, are not to be regarded as vectors of the disease because of the absence of naturally infected specimens in regions of very severe endemicity where nearly 4 per cent of quadrimaculatus were found to be infected, and because of their demonstrated almost exclusive fondness for the blood of animals, and not of man.

With regard to the work of others, it can be said that up to the present only one naturally infected specimen of punctipennis and three naturally infected specimens of crucians have been recorded. This circumstance, in connection with the very small, though definite number of specimens of crucians and punctipennis found by the precipitin test to have fed on the blood of man, leads me to believe that the chances of malaria's being naturally transmitted by these species, while physically possible, are too remote for consideration by the practical sanitarian.

The Advisability of Differentiating Between These Species in Applying Control Measures.—Species control or "species sanitation" is a practical measure and is being used in other countries. In the South we must first ascertain whether the three species exercise any preference in selecting breeding places. At our Station we have observed certain tendencies in this regard. For example, quadrimaculatus is found exclusively in still water. The same is true of crucians. Punctipennis, on the other hand, is found in or near running water or in still water near by, although this species has been found in many types of still water. The point is that quadrimaculatus, the effective malaria carrier, will not breed while the current of water is maintained. Before a stream is impounded this species is either absent, extremely sparse or not found until drought in late summer has caused pools to form in the bed of streams. After the current is re-established in this stream quadrimaculatus tends to disappear. Probably there is not an absolute disappearance, but one equivalent to a reduction to a number at which malaria does not occur. This is analogous to the relation between the stegomyia index or numbers of these mosquitoes below which yellow fever cannot be transmitted.

The physical state or condition of the water which renders it more suitable as a breeding place for quadri-

maculatus may be related to abundance of food, for it differs with these changes in physical state and in plankton food while the water is in motion and at a time when punctipennis will breed and an increase in the amount of plankton upon stagnation at a time when quadrimaculatus becomes implanted.

The biochemistry of the different breeding places varies with these changes in physical state and in plankton, and this is indicated in the tendencies of different bodies of water, from which we have taken the three species, to have a different reaction, when measured by a determination of the hydrogen-ion concentration of the water. That is to say, in swamps, ditches, borrow-pits and other bodies of water from which crucians has been taken, the average p_H will be sub-acid or minim-acid. Punctipennis taken from stagnant stream margins, puddles, pools, and limesinks, is usually found in water which is neutral, sub-alkaline, or minim-alkalin, while quadrimaculatus found in wooded ponds, pools, limesinks, and swamps, ranges between the other two species, and its curve of p_H frequency denotes tendencies different from those of the other two species. The curves of frequency depend partly on the frequency of occurrence of certain types of water from which our larval collections were made. Still, when we study the types of water collections frequented by the three species for breeding we come upon definite tendencies and never find punctipennis, for example, breeding in swamps with acid water, although crucians and quadrimaculatus may abound therein. On the other hand, crucians and quadrimaculatus are not to be found in running water or in wells.

Considering certain other collections of water irrespective of their physical or biochemical state, we have noted tendencies for the occurrence of certain species due to, as yet, unascertained causes.

Few or no anopheles were found in a number of borrow-pits regularly examined throughout the year. When larvae were present crucians was the species encountered. Quadrimaculatus larvae were very rarely taken from borrow-pits unless the pits were old with a rich growth of vegetation and near habitations. Even then, they appeared in very small numbers and for a very short period of time when breeding of quadrimaculatus was very scanty indeed, due to drying up of their customary breeding places. None of these borrow-pits is in any sense a menace to health. While it is true that borrow-pits may become a nuisance or menace to health, in the economical administration of malaria control work some discrimination at first must be exercised in their elimination.

Wells.—In India wells become breeding places for malaria anophelines. The same is probably not true in the Southern States. Plankton is very scanty in well water and in our experience anopheles breeding likewise is scanty. The anopheline species usually encountered in wells is punctipennis. Rarely in an abandoned well crucians has been found, but quadrimaculatus has only been taken once, and this was in a partly filled well without a curb, and in a neighborhood where all the quadrimaculatus breeding places had dried up, and in this instance larvae were detected only on one occasion.

Other collections of water which have been under repeated examinations for periods upward of two years have failed to disclose breeding of quadrimaculatus. A number of ditches near habitations have bred crucians during the greater part of the year, and in winter have yielded punctipennis occasionally, but they have always been free from quadrimaculatus. Other ditches near habitations, breeding crucians or punctipennis, rarely have bred quadrimaculatus except when the customary places for quadrimaculatus had dried out. Here may be noted a tendency for quadrimaculatus to refrain from breeding in certain ditches excepting during periods of drought. Their numbers are then always small and may remain below a number calculated to support malaria in the locality.

Swamps and Ponds.—These, when situated more than a mile or two from habitations, have usually been found to breed crucians only. When habitations are within flight distance quadrimaculatus may become implanted. The need, therefore, for controlling crucians breeding in such locations is not imperative, and these places should wait until the more urgent problem dealing with quadrimaculatus has been ascertained and solved.

Economic Reasons for Differentiating Species.—Dr. Carter has already said that "to spend a dollar on sanitation and get less than 100 cents benefit is not only bad business, but bad sanitation." We all know that malarial control operations are expensive. Expensive also is the maintenance which must be provided for. The money to pay for these operations must come out of the pockets of the local tax payers. A prudent and humane expenditure of funds requires that the worst places, the real sources of infection, should be considered first. To do this the specific nature of the problem should first be determined, instead of attempting to use general measures which may have been based on experiences derived from other regions having their own special kinds of anopheles and habits.

In making these observations it should be stated that the studies are still being pursued and are as yet incomplete. Certain tendencies in the breeding preference of anopheles undoubtedly have been revealed and these tendencies must be studied for a sufficiently long time before generalization can be made and explicit directions given to health officers and sanitary inspectors.

If it emerges, as I think it will, the anopheles have preferential breeding places and that we can, in a good many instances, specifically carry out species control, then the method of identification of species by their larval characters developed in our laboratory at Leesburg by Dr. Paul F. Russell, will be a valuable aid to malariologists and sanitarians.

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DISCUSSION (Abstract)

Dr. M. A. Barber, U. S. P. H. S., Greenwood, Miss.—We have made a four years' study of the habits of anopheline larvae in the Southern United States, and the longer we study the less disposed we are to generalize. As regards the preference of the different species for certain breeding places, we arrived at some rough generalizations which have been getting rougher every year. In the spring we have found abundant anopheles punctipennis in ponds and in small pools in or near woods. Such punctipennis-containing pools are quite independent of streams and are common in the southern parts of Georgia, Alabama and Louisiana.

We have long been making observations regarding the relation of anopheles breeding to the hydrogen-ion concentration of waters, and we have found all three of the common species of anopheles highly adaptable to natural waters of greatly varying hydrogen-ion concentration. In aquaria, where widely varying hydrogen-ion concentrations were constantly maintained, anopheles quadrimaculatus and crucians seemed to develop from egg to imago at practically the same rapidity.

As regards the part played by the different species of anopheles in the transmission of malaria, negative epidemiological evidence is not convincing. We find a low malaria rate in parts of the rice-growing regions of Arkansas and Louisiana in which anopheles quadrimaculatus, a known carrier, is very abundant.

Likewise the absence of naturally infected anopheles crucians is evidence of weight only in a very long series of dissections. One may get long negative series in dissections of anopheles quadrimaculatus. In feeding anopheles on malaria carriers we have found crucians highly susceptible to infection. In one experiment, where crucians and quadrimaculatus were fed at the same time on the same patient, practically identical percentages of infection were obtained and sporozoites formed in the gut in both species on the same day after biting.

As regards the biting habits of anopheles crucians, Mr. Hayne and I can testify from personal experience, for in some experiments with man-baited mosquito traps we served as the baits. Anopheles crucians bred in salt marshes are eager biters of man, even in the daytime.

In sum, we do not believe that anopheles crucians, at least, can be exonerated as a carrier of malaria.

Dr. W. V. King, U. S. Bureau of Entomology, Mound, La.—At Mound we have a great predominance of one species, quadrimaculatus, while our yearly collections show only 2 to 3 per cent of punctipennis and crucians. The fact that they are present but only in relatively small numbers although the breeding areas are extensive and well suited to the production of quadrimaculatus is a striking example of the difference between the three species in their breeding requirements.

Punctipennis is strictly a spring species with us and crucians is found in the spring and early summer. Like Dr. Barber, I do not care to generalize on the kind of breeding places selected by the different species except that the larvae of punctipennis are sometimes found alone in certain temporary pools and in the shallower borrow-pits along the Mississippi River where no vegetation is growing.

We have made a very large number of examinations of adult anopheles for malaria infections, but unfortunately the small proportion of punctipennis and crucians which were examined did not give a great deal of information on these two species. Probably several hundred of each have been dissected without finding parasites, but these negative results are of little significance since the infection rate, judging from quadrimaculatus, is normally very low.

I should like to ask Dr. Darling what percentage of the mosquitoes examined at Leesville were found with the sporozoite stage of the parasite?

Mr. J. A. LePrince, U. S. P. H. S., Memphis, Tenn.—Dr. Darling wisely stated that it is very necessary to study each locality. We find that local changes in subsurface strata, as well as local changes of topography, are often responsible for producing intermittent or permanent breeding places of anopheles quadrimaculatus in territory that might appear to be favorable to anopheles punctipennis only. Such conditions may produce malaria foci in what we might term territory apparently suitable for punctipennis only. In this connection seepage outcrops may become of decided sanitary importance.

Many surveys have been made which indicate that we can have a community heavily infested with punctipennis, some malaria carriers present and very little transmission of malaria. In several instances malaria control campaigns have been conducted in which sources of anopheles punctipennis were ignored, but the public demands mosquito freedom as well as malaria freedom and health workers find it advisable to comply with what the public insists upon having.

Regarding roadside borrow-pits, in some localities they are prolific sources of anopheles, while in other cases they may not be of importance. Future study will probably show us the reasons why this is true.

In small spring water supplies I find larvae of punctipennis and an absence of the larvae of other anopheles.

Perhaps ten years from today our public will allow us to plan campaigns against the local malaria-carrying mosquito and to ignore other mosquito breeding places. They are more interested today in reduction of the mosquito nuisance.

Mr. L. M. Fisher, U. S. P. H. S., Columbia, S. C.—This year at Chester we have found some crucians, but no quadrimaculatus. There were some collectors of quiet water in which quadrimaculatus could be produced, particularly in quarry pits. The edges of the water con-

tained a great deal of vegetation, but we found only punctipennis.

Dr. King brought out the point that it takes a large number of mosquitoes to keep malaria alive. It takes a large area to produce a large quantity of mosquitoes. The natural breeding places for quadrimaculatus in the vicinity of Chester and in the country near there is such that we do not have extensive areas, and it is difficult, at least for me, to see how we could get the malaria we have there, from the small number of breeding places there.

I also want to emphasize the point Mr. LePrince made, that we must control all the mosquitoes if we want to get the tax-payers' money, and it makes it very difficult to do selective control work of the different species.

Dr. L. D. Fricks, U. S. Public Health Service, Memphis, Tenn.—I wish to add a few words on the subject of borrow-pits in relation to mosquito production. "Borrow-pit" is rather a loose term. Borrow-pits vary greatly in character even in the same locality, and those of one region may be and frequently are entirely dissimilar to those of another in regard to mosquito production.

Dr. King made the statement that in northeast Louisiana there is an appreciable amount of mosquito breeding in borrow-pits, particularly of punctipennis in early spring.

It has been reported to me since 1919, by service officers working in south Georgia that the borrow-pits found there very rarely produce anopheline mosquitoes during the summer months. Borrow-pits are of common occurrence along the recently constructed highways in south Georgia. Usually they are comparatively shallow with clean banks, little vegetation, and generally without shade of any kind. Under these conditions one would not expect to find, and we have not found, Anopheles mosquitoes producing to any extent.

In regard to the malaria situation at Chester, South Carolina, which was reported by Mr. Fisher, I may say that this has been a subject of considerable interest to those of us who were acquainted with it. Several years ago Mr. Fisher reported a sharp outbreak of malaria in Chester and after a careful survey and study, during which he was unable to find any Anopheles quadrimaculatus, he was inclined to attribute this outbreak to Anopheles punctipennis. Mr. Fisher has repeated his mosquito surveys in Chester several times since the original outbreak and has never found Anopheles quadrimaculatus. I understand he is of the opinion that Anopheles punctipennis was responsible for the malaria in Chester, South Carolina. I believe that we are generally agreed that while such a condition is possible, it is decidedly exceptional.

Dr. C. A. Kane, Virginia State Health Department, Richmond, Va.—In Williamsburg, Virginia, where only punctipennis breeding was found and with some malaria the health officer was satisfied that the malaria was being carried by punctipennis. In July last, a survey was made in detail covering every part of the community and to our surprise two permanent ponds were found back of the State Asylum, that were breeding quadrimaculatus. They had evidently bred quadrimaculatus in previous years. These ponds have been drained and the territory will be studied during the coming year.

Mr. A. F. Allen, Assistant Sanitary Engineer, United States Public Health Service, El Paso, Tex.—I am in the lower Rio Grande section of Texas where the conditions are different from those in the rest of the southern United States. The hot season is longer and the seasons are inverted due to the irrigation. When it is the dry, rainless season, we have it wet, and the wet or rainy season is drier, from a mosquito production point of view, than the dry season.

About two weeks ago I collected a pint of water from a borrow-pit along a canal. It had between two and three hundred Anopheles larvae at the time it was taken, and they were all taken within twenty feet along the borrow-pit. We hatched out five different kinds of Anopheles from that one pint of water. The predominating one was psuedo-punctipennis. The next was probably punctipennis, the next quadrimaculatus, and the next albimanus, which so far as we know, exists nowhere else in the United States, except in that thousand square miles of territory down there; and lastly, crucians.

We are still wondering which is, or are, causing the malaria down there. Any one of the five is in sufficient numbers to create the malaria which is present. We are not trying to do much with it because we are on yellow fever control, but we are trying to find what is causing some 5 or 6 per cent of the people down there to have malaria each year.

When five kinds of Anopheles come out of the same borrow-pit it is an unusual condition. I doubt that hydrogen-ion concentration can have much to do with the suitability of this borrow-pit water for the various species.

Dr. Darling (closing.)—Dr. King asked the percentage of sporozoa carriers in the larvae. I have not the figures, but it was something under one per cent.

PROGRAM FOR COUNTY-WIDE MALARIA CONTROL*

By S. W. WELCH, M.D.,
State Health Officer,
Montgomery, Ala.

I am a practical, every day working man, and in a gathering of scientists, I have considerable difficulty in knowing what I think about things. After a discussion like this, I am still more at a loss to know what I think. But I am very proud of the accomplishments in Alabama resulting from the team work of my scientific and practical associates.

The question of malaria control on a county-wide basis had its origin in Alabama. One of my assistants worked out a plan and submitted it for approval. After a discussion by the whole group, a plan was agreed upon, and the first demonstration was made in 1921 or 1922.

Since that time we have worked out a still better plan, which seems to me to be growing more practical every day, but at the same time is changing every day. The great trouble in the public health game is that the

*Read before the National Malaria Committee (Conference on Malaria), meeting conjointly with Southern Medical Association, Eighteenth Annual Meeting, New Orleans, La., Nov. 24-27, 1924.

things we do one year, we can't do the next year. At the same time we have made some progress.

The malaria program should always be a part of the general program of public health work. It is a mistake for any health unit or any health organization to specialize on any one particular thing to the neglect of all the other public health activities and public health interests which come up for consideration.

In putting over a malaria program on a county-wide basis, we must have a perfectly definite plan worked out for malaria control that dovetails into all the other activities.

The county health officer should locate his malaria problem. He can do that very easily by a school census and by statistical reports that come in. Nine times out of ten he will find that probably he has mut one malaria focus in his county, or certainly not more than two or three.

I was under the impression when we started that malaria was widespread over every county in Alabama. The scientists demonstrated clearly to my mind that it was a local proposition.

In my home county, which is about sixty-five miles long and thirty miles wide, we have one malaria focus, and that is along a stream about ten miles long on which is an impounded water. At one time I made my living on malaria infected people. There is no malaria there now.

You must make a special study of the problems of each county, locate the malaria, ascertain the size of the project and then decide which of the many methods of control you are going to use before you start in. If you don't you will waste much time and more money.

A malaria program should never be financed out of the appropriation for a health unit. It is an extra piece of work and does not affect the whole population in the county, or even the whole population of a community. It is local, and should be supplied either by a special appropriation by the county, or by a special appropriation added to by those who are immediately benefited, the drainage district area, for instance.

We have recently passed a constitutional amendment in Alabama, which permits the establishment of drainage areas. We expect, by reclaiming waste land and bringing into cultivation rich land along the border, to get further credit for having controlled malaria.

The only project which we have undertaken which is distinctive from our general work this year has been the one of the City of Selma. There the county put up $5,000, the city put up $5,000. The state directed the work through the machinery of the local unit, and the success of the project satisfied all of our expectations.

There are several methods of control which have been gone over so often as probably to be out of place at this particular time, but I want to insist upon this one point: that you must find out where your problem is, what it is, the method which you will use, whether it is drainage, or whatever it is, select the method of control that promises to be most effective in that particular locality, and eliminate from your mind the idea that malaria is disseminated all over the territory which you wish to control.

Go after the most heavily infected places first, because those are the foci from which malaria is scattered over the entire state.

DISCUSSION (Abstract)

Dr. W. G. Smillie, I. H. B., Andalusia, Ala.—Rural malaria control can best be undertaken in an area where there is a well established county health unit, having a carefully balanced program. Sporadic effort that may be undertaken to control malaria by the state health department or other agencies will be of some avail, but the work is not continuous and therefore is not productive of permanent results.

Dr. Welch has already indicated what the county health officer can and cannot do. The first duty is to determine the prevalence of, and the location of the foci of malaria in his county. This may require one or two seasons.

The county health officer should then choose one, or at most two foci a year, and study them thoroughly. The county health officer having studied the chosen malaria focus well, and having determined where the Anopeles quadrimaculatus breeding is occurring which is causing malaria, should then call in an expert malariologist to help decide the best methods of control. He will be wise if he refrains from making any suggestion as to control measures before receiving expert advice.

If we are to have successful rural malaria control in the South, each state health department must have an expert malariologist on the staff. He can best be a member of the department of epidemiology. An ideal arrangement would be to have a state epidemiologist who is an expert in malaria control. He should be available to go to the various counties, after the health officer has studied a given malaria focus, and determine for the county health officer the best method of control for the given project. If drainage is the best method to be employed, then the state department of sanitary engineering can be called into consultation in regard to methods to be followed. If some other method of control is more feasible the state malariologist will outline the plan of control and advise the health officer and the other persons of the county that are most concerned as to the best methods of procedure.

Dr. W. S. Rankin, Health Officer, Raleigh, N. C.—I wish to know whether Dr. Welch has had any experience in the method of control described in a county located in a tidal section, a county in which the water in the rivers and streams, rises and falls to an appreciable extent with the tides.

Dr. H. A. Taylor, Raleigh, N. C.—We always attempt to organize a county health department first. Many of our failures have been due to the fact that we have left no one behind actually to carry on or continue the control methods after we withdraw.

In dealing with malaria in the tide water section we have no special foci of infection. The infection ranges from 10 to 16 per cent in the sand hills and from 50 to 60 per cent in the bottom or low lands. We cannot apply anti-larval measures in our section.

We find that a majority of the lands are owned by a

few resident owners. Their homes, as a rule, are well-constructed and located favorably, with reference to the breeding of mosquitoes, while the homes of tenants are loosely constructed, will not lend themselves to screening and are very favorably located for the breeding of mosquitoes. It is here that the health officer experiences a most difficult problem in malaria control. He has approximately 75 to 80 per cent of the population with no means of control at his command except quininization.

Now, unfortunately, in the tide water section we have not the preferential breeding places that you have in the hill section. A few years ago we began with a county-wide propaganda and after making a complete survey we found punctipennis and crucians breeding in certain isolated places. We thought at that time quadrimaculatus would select certain places in which to deposit eggs, but as the summer months approached we found that all three were breeding in places alike. Therefore, we cannot differentiate between the breeding habits of the three species in eastern North Carolina. It is here that we call in every known method of control at our command, using the health department as a nucleus. We dovetail our work with the general routine duties of the health officer and make this a distinct part of his work in an attempt to get him to devote 75 per cent of his time to malaria control work. We have been fairly successful.

Mr. Frank R. Shaw, U. S. P. H. S., New Orleans, La.—St. Mary Parish, Louisiana, where I worked this season is only one hundred miles west of New Orleans and is bordered immediately by the Gulf. About forty per cent of the parish area is subject to slight inundation due to tidal fluctuation of the Gulf. These tidal changes and conditions of inundation may be wholly different from those of rivers, but the method of drainage control might be equally applicable.

At the town of Patterson the officials were desirous of malaria mosquito control, but a preliminary survey revealed a stagnant tidal swamp entirely across the edge of the town and extending to a sluggish bayou and thence to the Gulf. The conditions looked prohibitive, but engineering levels from the bayou to the edge of town and periodic reading of a gauge in the bayou showed that, although average daily high tide was three-tenths of a foot higher than the average ground at the edge of town, there occurred an outfall every 12 hours amounting to from 1½ to 3 feet.

By constructing a canal in the swamp parallel to the edge of town and through an existing railroad culvert and then to the bayou, the building of a 1½ foot levee along the tide side of the canal from high land to the railroad embankment and the placing of Calco Automatic Tide Gate culverts, we established a barrier to high tides and yet availed ourselves of the tide fluctuations through the automatic operation of the gates.

The gates are to be found on the market and for all practical purposes are very efficient, but it seems that little knowledge exists as to their purpose and practical application to many conditions otherwise unapproachable. They are being used to some little extent in Louisiana.

The ditching on this project involved 7200 feet of 20-foot canal and 3500 feet of 5-foot laterals, all of which was constructed with dynamite.

Mr. J. A. LePrince, U. S. P. H. S., Memphis, Tenn.—Where the rise and fall of tidal water is much less than it is in North Carolina, anopheles production is more difficult to control. But even under such conditions we do not face an impossible problem, and as Dr. Welch stated, success depends upon the selection of the correct method of procedure.

Even when drainage and use of larvicides are not practical there remain other control methods that can be used.

With properly developed public cooperation we can control malaria. Lack of funds and drainage difficulties may make the problem more difficult, but do not make control impossible.

Dr. T. H. D. Griffitts, U. S. P. H. S., Montgomery, Ala.—If you have an organization to do anti-typhoid work or hookworm work or any other kind of public health work, you will have an organization that in a short time can be made to do malaria control. The whole thing hinges on getting county health organizations together. In the malaria counties select the county health officer who is already a malaria man, or one who will become sufficiently interested in the control of malaria to make a head of a proper organization in that county.

TRAINING FACILITIES FOR MALARIA PERSONNEL*

By L. D. FRICKS, M.D.,
Surgeon, U.S.P.H.S.,
Memphis, Tenn.

Before we begin to discuss training facilities for malaria personnel let us determine whether we are in general agreement concerning certain major propositions which must be included in or excluded from the discussion if we are to make any headway in the limited time at our disposal. Let us assume that the malaria personnel referred to in this discussion are to be used in the control of malaria in the United States—either as assistants to or as a part of the properly constituted health forces. May I also assume that we are agreed on the proposition that malaria in the United States is a rural health problem, and as such, should be handled by a full-time county health organization, along with other health problems. And further, that none of us would be willing to advocate the training of malaria personnel to take the place of the county health unit and devote its entire time to malaria control, as has been done in tropical countries.

If these propositions are granted, then we come at once to such pertinent questions as these: What personnel is most badly needed by the state and county health departments of the South in the control of malaria? What facilities do we have for training this personnel? How can these facilities be used to best advantage? How can they be expanded in accordance with our needs?

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It inevitably follows that as the fight against malaria in the United States changes from one phase to another, as it has changed in the past, and no doubt will change in the future, the type of trained personnel most badly needed will alter. At the present time it seems to me each state health department of the South should have the following trained personnel: A sanitary engineer who knows the principles and practical application of drainage methods in mosquito control; an epidemiologist who can be relied upon to determine what are the more important factors which enter into the spread of malaria in a given locality; a vital statistician who can stimulate the reporting of malaria cases, evaluate and gradually correct malaria records sent in to his division; a laboratory director who is competent to diagnose malaria from thick and thin blood smears, and anxious to extend this service throughout the state.

For the county health unit, we would suggest that the county health officer himself should be trained in the principles of malaria transmission and malaria control, so that he can drive home the facts intelligently to the people and develop a strong desire in them to rid themselves of the malaria burden. No great progress can be made in the control of malaria, as it must be controlled in the United States, until the people themselves earnestly desire it, and are willing to pay for it. The county health officer should know how to define his malaria problem and determine what trained assistance he may need from the state health department or other cooperative agency in handling this problem. The county health unit should contain a sanitary inspector who has practical knowledge of malaria transmission and malaria control. In those counties which have a malaria problem, the inspector should give the greater part of his time during the summer months to malaria control; during the winter months he may well be employed in other rural health matters. It is my judgment that at the present time the training and the duties of the sanitary inspector are more important than those of any other member of the malaria personnel. The sanitary inspector, with proper training, enthusiasm, and an unhampered field of action, can perhaps do more than anyone else toward the control of malaria in the United States under the program which we are working and should work. In addition to the sanitary inspector the county nurse should also be informed of the principles of malaria transmission and control. She can accomplish much good in personal talks while visiting homes and schools in the county.

Now what facilities have we for training all or any of this malaria personnel? Something has been done in this direction in the past few years, perhaps much more than can be done in the future. To my knowledge five agencies have contributed toward the training of malaria personnel in the United States, possibly there are others which I do not recall at this moment. The Sub-Committee on Medical Research and the Sub-Committee on Engineering of the National Malaria Committee have been very active in getting malaria and malaria control taught in the medical and engineering schools of the United States. The Bureau of Entomology has given instruction along entomological lines to a number of malaria workers at its field station, Mound, Louisiana. Probably the Public Health Service has trained a greater number of malaria workers, and along more lines, than any other agency. Hardly anyone who has to do with malaria control in the United States at the present time has not gained something from Dr. H. R. Carter or Mr. J. A. LePrince, and service officers trained by them have carried their instruction to local health officers throughout the South. The World War offered the Public Health Service an unusual opportunity for training a large number of medical officers, sanitary engineers and laboratory technicians in malaria and malaria control methods. The International Health Board has contributed greatly to the training of malaria workers by sending them to the field where they could observe practical demonstrations of different methods employed in malaria control. Recently the International Health Board has established a training school for malaria workers at Leesburg, Georgia. It should not be forgotten that the State Health Departments of many Southern States have added their bit. By establishing divisions for malaria control they have encouraged their personnel to study malaria and develop themselves, generally in the practical school of experience, into trained malaria workers.

We must confess, however, that there has been no coordinated effort undertaken in the United States for the adequate training of malaria personnel along all lines. The establishment of a training school of this character has been discussed by public health officers for several years, but the service has never been in a position to finance such a school, to bring pupils to it. It is to be hoped that the International Health Board, which has a greater freedom in the expenditure of its funds, will be able to continue and expand the training school for malaria workers which has been established at Leesburg, Georgia. The one suggestion, however, which we would make relative to the training of malaria personnel for practical purposes is that the greatest good can be accomplished at the present time by making this instruction practical and directing it particularly to the sanitary inspector.

DISCUSSION (Abstract)

Dr. S. T. Darling, Leesburg, Ga.—Dr. Fricks has admirably expressed the need and requirements for training and training facilities in malaria. I want simply to emphasize what he has said. I felt that in our work at Leesburg, the investigator side was not the most important one, but that equally important was the opportunity we had there for giving instructions, some of it very elementary, in malariology.

First, we have given instruction to some of the medical officers of the International Health Board, but little by little we have added to that. Health officers, epidemiologists and one or two sanitary inspectors, and even technicians, have been sent to us, and we can give them instruction in the various phases of malariology, chiefly so far as regards making the survey, making the inspection.

At present we haven't undertaken any control work, but we hope that in the near future we shall be able to undertake something of that sort.

I have been very much impressed with the lack of thorough knowledge that I have encountered among some of the men who have been sent to me. I can see the great need for instruction in some of the simple and elementary things in relation to malaria.

Dr. K. F. Maxcy, U. S. P. H. S., Montgomery, Ala.—It is hardly feasible to assemble health officers, inspectors and nurses at any one point for instruction. Funds are lacking. Instruction must be given in the field where malaria work is being done. This means that in each state provision should be made for a man attached to the State department of health who is competent to instruct the personnel of the various county health units in malaria work. In this way, perhaps, we can accomplish our end more quickly than if we tried to organize the teaching on a more concentrated basis.

Dr. C. A. Kane, State Board of Health, Richmond, Va.—We have found it necessary to give special training in malaria control to our county health officers in eastern Virginia. In 1923, eight counties were selected and malarial mosquito study stations located in each county to be studied by the health officer throughout the year. This consisted of weekly collections of larvae, hatching and identifying of mosquitoes, and weekly collections of the adult mosquitoes from houses, stables, and other feeding places, and identifying these mosquitoes and making a record of them. The health officers were assisted in this work by Dr. L. L. Williams, Jr., and myself until they were thoroughly familiar with the routine study which is used by Dr. Darling in Leesburg. In the past we have had health officers from Hopkins and one from Harvard. Although they had theoretical knowledge of mosquitoes, and knew that it was necessary to drain, use oil, and give quinin they were unfamiliar with field work and were not thoroughly familiar with the habits of anopheline mosquitoes. We find it necessary to give special instruction to each health officer that we employ in Virginia regardless of his experience in the past.

Dr. W. G. Smillie, I. H. B., Andalusia, Ala.—In rural control, our line of first defense must be the county health officer and his assistants. Our object at the Training Station in Andalusia, therefore, has been to give newly appointed county health officers a brief field training in malaria control. Men have come to us during 1924 from Oklahoma, Tennessee, Alabama, South Carolina, Arkansas, Texas and Georgia. When a new county health officer is appointed, a small fund is appropriated for two to three months training in county health work. Those men that will have a malaria problem in their county are first assigned to Dr. Darling's malaria research laboratory in Leesburg, Georgia, to learn the fundamentals of anopheline entomology and the general principles of a malaria survey. After one month, men are then assigned to a county in which there is malaria, and as a part of their general county health program, they take an actual part in the activities of the health unit, under the supervision of the director of the training station. If the novice in training remains for a third month, he is assigned to a definite malaria focus which is studied by him in detail, such as making suitable sketch maps, house to house visits, anopheles surveys, etc.

With this short preliminary training the newly appointed county health officer goes to his assignment with at least a general idea as to the methods of approach to his malaria problem, and if he should be so fortunate as to be employed in a state which has a state malariologist, he should be able to conduct rural malaria control satisfactorily.

METHODS OF MALARIA CONTROL TO BE ADVOCATED WHERE ANTI-LARVAL MEASURES ARE IMPRACTICABLE*

By W. S. RANKIN, M.D.,
State Health Officer,
Raleigh, N. C.

The subject implies that there are places where anti-larval measures will not control malaria. I did not suggest or select that subject. It is in line, however, with very high authority as to the practicability of malaria control in certain places.

There is a little town in eastern North Carolina with about two thousand people, where Dr. Henry R. Carter once went to make a survey. When he had gone over the town he met the people to discuss what measures they could take against malaria. They said:

"What can we do, Doctor?"

"The only thing you can do to get rid of malaria in X," he said, "is to move to Y."

With the advances that have been made since that time, some twelve or fifteen years ago, none of us here now would say that malaria could not be controlled within reasonable expenditures in any locality. Not in a county. There is a difference between a town and a county, but in a particular town or locality.

I asked the question this morning, if anyone knew of a tidal country where malaria had been controlled on a county-wide basis, and one gentleman replied that he was working in such a county and cited the control of malaria, mind you, in a locality three miles square!

The methods of control that have been worked out here and in Alabama and that have been emphasized by Dr. Welch and Dr. Smillie and Dr. Maxcy, are thoroughly sound, and I am fully sold to the idea that malaria can be controlled when it exists in a community, or in a circumscribed locality. The question that I have to discuss is: What are you going to do with malaria when it is not circumscribed, but county-wide, and in a county where drainage measures are so expensive as to be practically out of the question.

Now what do I mean by such a county? There are counties in eastern North Carolina where from 30 to 50 or 60 per cent of the people have malaria. There are areas in those counties of from 200 to 300 square miles

*Read before the National Malaria Committee (Conference on Malaria), meeting conjointly with Southern Medical Association, Eighteenth Annual Meeting, New Orleans, La., Nov. 24-27, 1924.

heavily infected with malaria. I am *not* talking about a locality 2 miles one way and 6 or 8 miles the other way. I am talking about a big piece of country where from 30 to 40 per cent of the people have malaria in a tidal section, and not in a Piedmont section.

The old health officers here, my friends Welch, Ferrell, Fricks, and others, know, and will bear me witness that when this malaria work was started on a state basis several years ago, I took the position that the problem was still one largely of research, and that there were so many things to be found out about it, that there was a question in my mind as to whether the states and counties with their limited machinery and limited resources should attack it until the research worker had gone further.

I was persuaded, however, by these two gentlemen and by the example of my other friends in the South, to go into it, so we started malaria control in the tidal section of eastern North Carolina.

The International Health Board agreed to put up $2,000 per year per county. The State Board of Health agreed to put up $4,000 more, and asked the county for $4,000, making $10,000 appropriation. The idea was to feature malaria as the major local health problem. The other things were minor. The further idea and plan was to work two years in a county, making a $20,000 piece of work.

We shall have finished the work on the first of January in four counties and shall have finished the first year's work in three other counties, and three more counties now want to start in, making ten counties in all.

My idea when I went in, when I was sold, (and I am not so sold now as I used to be) was that we would work about twenty of twenty-five counties in eastern North Carolina.

Here recently my friend who did so much to encourage me to get into this game, has raised the question as to the practicability of the measures in these counties, where drainage, we think, is out of the question.

I have seen Savannah and Jacksonville doing antimalaria work of a very high order. I know that malaria can be controlled there. I am talking of a rural section, a tidal area, where nobody that I know who has gone into it would dare to propose drainage.

The only thing that we have been doing, and the only thing that we know now to do, is to use quinin. We have gone into the schools; we have gone into the homes with nurses, have taken the blood, gotten the history, and told them all about how to use quinin. What have we accomplished?

The original survey showed that about 50 per cent of the people in this rural section had malaria. A survey of 1,400 people in the same area conducted last year, showed that there had been about a 30 per cent decrease.

Unquestionably a lot of good has been done. There is definite progress. The first year the statistics showed 50 per cent of infection. That may have been higher than the average year or lower than the average year; and the next year's rate may have been higher or lower. However, such figures as we have, questionable in their evidence, perhaps, show that there has been about a 30 per cent reduction.

The question is whether the same amount of money spent on some other health problem would not have accomplished a larger reduction in morbidity and mortality.

Mr. LePrince said there was another way than the quinin method by which we could attack malaria. But how long will these indifferent, anemic people keep houses screened? It isn't so much screening the house as it is getting the health sense into the malaria infested population, that counts.

The State of North Carolina isn't going to continue this piece of work which it was encouraged to assume, if the United States Public Service and the International Health Board that urged us to get into it, raise a question as to the practical value of it.

DISCUSSION (Abstract)

Dr. John A. Ferrell, I. H. B., New York, N. Y.—The type of county in which Dr. Rankin in North Carolina is attempting to combat malaria is found on or near the sea coast from Mexico to Maryland. Malaria in this vast area is an outstanding problem. The country is flat, sparsely settled. The streams are deep, tortuous, and sluggish, and generally are influenced by tides and floods. Economic resources, as a rule, are quite limited.

North Carolina and other coastal states, because of malaria, are confronted with a difficult problem, but we do not expect that the authorities of North Carolina, or any other state, will accept the obstacles as unsurmountable and consider for a moment having the people abandon these extensive areas in favor of the anopheles mosquitoes.

The attempts to conquer malaria in these sections will be continued. Infancy and maternity, and other health problems, should be given consideration by the health organizations in logical sequence, but should not be concentrated on in the very malarious communities until malaria has been reduced to a degree which at least renders them safely habitable.

Let us all stand by our guns and continue the fight, bringing to our support any scientific investigators who may perhaps simplify a task which to some has seemed almost insuperable. The reduction in the incidences and severity of the disease as reported by Dr. Rankin and Dr. Taylor for some of their counties by the methods they employed is most encouraging.

The cost of more permanent measures of control that may be feasible, if too great to be borne locally, might be assumed in part, at least, by the state. Personally, I believe it is only a matter of time with the consequent growth in population and wealth before the fertile coastal plains of the South will completely banish malaria and afford healthful and inviting fields for agricultural and other pursuits, and that the result will be achieved by the state and county jointly working together.

Mr. J. A. LePrince, U. S. P. H. S., Memphis, Tenn.—Every opening leading into a house is a potential route of travel for mosquitoes. In 1917 Griffitts showed that

anopheles quadrimaculatus came down chimneys into the rooms of two-story farm houses in South Carolina. Where large openings have been trapped we have thus caught from a few to hundreds of anopheles per trap per night.

We are not doing enough toward destroying infected anopheles and are doing very little yet toward making them destroy themselves. Both of these control methods can probably be further developed, but even in their present status can be made of large practical value.

One of the reasons why more progress is not made in malaria elimination is that frequently those directing the field work are in doubt as to possible results obtainable and consequently are insufficiently interested. We can reduce malaria even where drainage and use of larvacides are not practical at the present time.

Dr. I. J. Kligler, I. H. B., Palestine.—In one malaria unit in Palestine we tried screening; in another, quinin. The screening was not very successful because, owing to the heat the people refused to keep the screens closed. House to house distribution of quinin reduced the amount of black water fever, as was shown by the microscopic examinations that were made after the mosquito season had closed. The following year a different method of supplying quinin was tried with much better success. Instead of distributing quinin from house to house, it was given to the children while at school. Other members of the community who had active symptoms were, of course, treated with quinin. At the end of the season the results showed that no black water fever had occurred, and that the number of relapses was lower than the year before. As the method of giving quinin to school children is much less expensive than attempting to distribute the drug to each individual member of the community, we are continuing the school work. Malaria has not been eliminated, but it has been brought under control at a very low cost.

Dr. H. H. Howard, I. H. B., Laurel, Miss.—In British Guiana, one of the European colonies in South America, I suppose they have one of the most difficult problems known with regard to sanitary drainage, soil pollution, and malaria control. The densely populated sections are below high tide level and are protected by sea dykes and tide gates. It is no infrequent thing to see ten inches of rain water over the lands standing until low tide when it can drain into the sea, and drainage at best is very imperfect. Malaria was a scourge to the people. Anti-larval measures did not suffice. Systematic quinin medication and prophylaxis, oiling, better drainage, some screening, use of bars, have done wonders to relieve the working population, who suffered most.

Often the seemingly impossible can be accomplished if we but try and persist in our efforts.

I remember some years ago that the statement was not infrequently made that it was impossible to have the rural populations in the Southern States put in and use sanitary privies. I have lived to see that disproved. Many of the people are building and using them.

I am not much in sympathy with the statement that screening is necessarily a failure as a means of protection from the mosquito. It possibly is never 100 per cent efficient, but whites are living in many places today in the Mississippi Delta in safety behind screens, often improperly looked after, where before screening was known or practiced, it would have been impossible.

I am not in sympathy with the statement that quininization is not worth while in sections where mosquito control is impossible.

There are large sections in the world where the systematic use of quinin has emptied the hospitals and put a malaria stricken labor population on its feet and back at work in the fields. This occurred in the British Colony to which I have previously referred. Quinin was administered to the entire laboring population in certain sections in appropriate dosage three times a week, with the previously mentioned results, and the saving of hundreds of dollars in hospital upkeep and labor loss from sickness.

Returning to screening, we all admit that successful screening and its maintenance are difficult, but where there is no easy way to control malaria the more difficult measures of control should not be abandoned because they are difficult and do not always produce perfect results.

Until we begin to advocate screening there will not be much screening done. We know a house can be screened effectively and that with the cooperation of an educated public effective screening can be maintained indefinitely. Screening should be a very helpful measure for malaria control in the section referred to by Dr. Rankin.

Why we have in a large measure in late years ceased to emphasize screening as a measure for malaria control I do not know. Is it because it is difficult and requires considerable educational work to secure effective cooperation from the people? Experts like Mr. LePrince, and others of experience, still believe in screening, I am sure. We should revive our interest and the interest of people in malarious regions in effective screening, and in the proper use of quinin.

I feel that whatever structure we have been able to build in public health work today, and we have reason to be proud of our accomplishments, has been built entirely upon the results of careful, painstaking research work of scientists.

We have interpreted their findings, translating them into field activities and control measures, and as administrators this is our part. The scientist's interpretation of his findings often does not stand the field test, practical application, which is the ultimate test of theory, but the work of the scientist in his proper field has formed the background for all of our public health work today and it is proper that credit should be given him.

I feel, since my own work for a number of years has consisted in a large measure in translating the findings of the scientific laboratory into active field measures, that we are greatly indebted to these men who have been paticularly and peculiarly equipped for investigation, and that we should continue to base our field work on the results of their investigations.

Dr. M. A. Barber, U. S. P. H. S., Greenwood, Miss.—In parts of the irrigated rice-growing regions of Arkansas and Louisiana anopheles quadrimaculatus is exceedingly abundant, yet the malaria rate is very low. A relatively high general standard of living conditions may be an important factor in keeping down the malaria rate. At all events, it is evident that a low malaria rate is possible in the presence of large numbers of anopheles quadrimaculatus.

I can confirm from personal observation the statement of Mr. LePrince that the screening of the houses

of negro tenants is a practical possibility. On a certain cotton plantation in Arkansas fully half of the tenant houses are screened, and Dr. Henry Thiebault, who has had many years of practice among negro plantation workers, told me that the negroes appreciate their screens and take care of them.

Dr. S. T. Darling, Leesburg, Ga.—It would be interesting to have Dr. Barber tell us something about the economic status of the people in the rice fields, whether they are well-paid, well-fed, etc.

Dr. T. H. D. Griffitts, U. S. P. H. S., Montgomery, Ala.—I did not understand Dr. Rankin, "Prince of Optimism," as to what methods they have applied that resulted in such discouragement on his part. I should like to know.

Dr. F. J. Underwood, Jackson, Miss.—Dr. Rankin obtained within a short period of twenty-four months, a 30 per cent reduction, according to statistics. I believe that the withdrawal of the support of the International Health Board is the only discouraging feature of the work to him. I see no reason why he can not work the problem out with the liberal appropriation made by the State Board of Health and with the proper local financial backing, which should be easily obtainable after his most splendid demonstration.

It is only over a period of years that we can get results in this work. With the educational work already done, generations yet unborn will profit by this program. I do not think that Dr. Rankin should feel discouraged at all.

Dr. Rankin (closing).—It really makes me feel good to hear people talk about my being discouraged. Usually I am put down on the other side. If a few of my friends who talk about my conservatism and caution get me in John Ferrell's conservative class, I shall think that I am about right.

I am not discouraged. I started out talking about what a sane and practical plan was available for the whole Piedmont section of the South. I stated that there had been, so far as the tangible evidence is concerned, a 30 per cent reduction in the short two years in which we worked in eastern North Carolina. Why should I be discouraged?

Dr. Fricks and Dr. Ferrell said to me: "Come down into the swamps of eastern North Carolina and let's play a cooperative game." I went with them.

Now that they have me down there, they want to leave me there. That is the whole proposition.

Dr. Ferrell says: "Where is the evidence?"

Dr. Ferrell perhaps has people back of him who are asking for a sign, who are not so full of faith. They want figures. You can not get figures with a problem of that sort unless you spend considerable money doing all your first survey over.

Now that will be fine work, provided the International Health Board pays for the second survey.

I will stay down there in the swamp as long as Dr. Ferrell wants to stay there, but the State Board of Health does not want him to get us started on something, then raise the question as to its practicability and value, and leave us holding the bag in the swamp like the freshman on his first snipe hunt.

FEASIBILITY OF ADVOCATING BUILDING DESIGNS OR REGULATIONS IN REFERENCE TO MOSQUITO CONTROL*

By J. A. LePRINCE,
Senior Sanitary Engineer, U. S. P. H. S.,
Memphis, Tenn.

We can assume the existence of a country with sanitary regulations so perfect, specific and so broad that if they were definitely applied sanitary conditions would be all that could be desired, and the system of procedure a model for us all to follow.

To what extent does the improving or increasing of sanitary regulations increase the amount of practical applied sanitation accomplished, and can we accomplish more applied rural sanitation with or without regulations whether enforced or otherwise. The writer is inclined to believe it is far more important to create increased public interest in sanitation, one subject at a time, than to confuse the public with a number of subjects and regulations that they do not understand, do not want, and sometimes indicate they do not propose to have. The public is compelled by law to pay the bills for public sanitation, and as they are buying health or welfare they are entitled to state what they desire to purchase. It is only fair to let them see and understand what is in the enclosed and wrapped package they are persuaded to purchase.

The objective of regulations, such as are indicated in the title of this paper, would be to get new rural homes so planned and so constructed that without seriously decreasing any advantages of the homes as they are built today, and with very little additional cost, the new homes could be made and kept effectively screened at minimum expense.

Can this objective be accomplished better by means other than sanitary regulations, state, county or local?

The speaker is of the opinion that properly applied publicity, and interestingly presented information that is not very dead, will go a long way toward making the property owners want to construct screenable homes.

A practical demonstration is the best means of publicity. The big problem is to get a sufficient number of property owners fully to realize that by malaria elimination the productive value and income from farm lands in malarious regions can be increased. We must not expect rapid progress along these lines. If we can get the new homes that are to be built so planned as to be kept anopheles proof at a minimum expense, we shall accomplish much.

The answer to the problem is a question. It is what is the best, cheapest and quickest way to get property owners and tenants to want very much to live in homes

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that can be both screened and kept so at minimum expense.

DISCUSSION (Abstract)

Dr. T. H. D. Griffitts, U. S. P. H. S., Montgomery, Ala.—The question of screening in counties where there is a health organization has been too much neglected. As health officers make their rounds of the county, why can't they make an effort to have every new house that is built in the county, though the construction is already started, so constructed that it may be economically screened?

I also wonder if it is not possible to extend the principle of getting a permit for building houses, not so rigidly as it is in the cities, but as is necessary in the country, so that houses may not be located in notoriously malarious localities, when they can as easily be located elsewhere. It seems to me that the county health officer in any state can at least know a part of the houses that are being built at any particular time and see the owner and talk to him of the importance of screening against mosquitoes, flies and other insects. We can appeal to him from the standpoint of comfort, as well as general and specific health.

I do not think anything along this line is being done.

If I were a county health officer today I would see every owner who is constructing a house in the county and get him to understand that an unscreened house in a community where typhoid may prevail, or where malaria exists, is not a home.

Dr. J. L. Bowman, Montgomery, Ala.—Where we have land owners who are interested enough and willing to build such houses as could be screened, we have no malaria. In other sections the land owners, although their tenants are dying of black water fever, or are ill with malaria, keep them in houses where no screen doors or screen windows could be fitted, and if it were possible to fit them there would still be abundant openings in the houses for mosquitoes to enter. That is the section of the country where we have the malaria. The land owners tell you either that they have no malaria in their community, or that they do not care if they have. If the tenants become sick, they will get others.

Mr. LePrince (closing).—I could talk on this subject for three hours, but what I would have to say can be boiled down to four words—IT CAN BE DONE!

MALARIA ACTIVITIES*

By JOHN A. FERRELL, M.D.,
International Health Board,
New York, N. Y.

The International Health Board's malaria program in the United States on which Dr. Fricks asked me to report, is generally known by those present.

As indicated by Dr. Fricks, financial assistance was given during 1920, 1921, and 1922 toward the co-operative measures for the control of malaria in towns. That feature of the work has been discontinued as far as practicable, except in towns included as a part of programs of county-wide malaria control by county health organizations.

The program for a county as a whole is exceedingly difficult because the anopheles breeding areas are extensive and financial resources limited. To succeed there must be a minimum of lost motion. Competent investigators, such as are now representing the Federal Government and also our own organization in this field, should be given every facility needed with the expectation that more efficient, economical, and direct methods of dealing with the rural problem may be found.

The International Health Board is committed to aiding investigative work of this character and to aiding official health agencies in their own development to the end that they may assume full responsibility for dealing with the malaria problem and also the other important health problems that may be encountered. Aid is given for a temporary period while the work is in a demonstration stage. Our participation in meeting the cost of the work should be as brief as possible, and the official agencies should adequately occupy the field without private assistance as quickly as possible.

Every state board of health having an extensive malarious area should be able to assign a medical epidemiologist having special training in malaria, a malariologist, to study the situation in each county or community and recommend the most economical and effective control methods. He should be able also to instruct and assist the personnel of the county health organizations. Moreover, it is important for such states to supply also the services of a sanitary engineer skilled in malaria control, who can supervise or cooperate in measures involving drainage, improved housing conditions, screening, and, in engineering projects, prevent "man-made" malaria.

During the present year our Board has aided 13 state boards of health toward employing malaria personnel such as I have just referred to, and it has aided 13 states toward establishing 27 county organizations, each of which for a period of from one to three years is committed to centering attention on malaria control. Moreover, it is gratifying to note that several other county organizations, many of which have been organized for several years, are now engaged actively and more or less independently in combating malaria.

*Report from Member of Sub-Committee, on Administration, National Malaria Committee (Conference on Malaria), meeting conjointly with Southern Medical Association, Eighteenth Annual Meeting, New Orleans, La., Nov. 24-27, 1924.

MALARIA CONTROL ACTIVITIES IN ALABAMA*

By S. W. WELCH, M.D.,
State Health Officer,
Montgomery, Ala.

THE ADOPTION OF ANTIMALARIA MEASURES BY COMMUNITIES

A full report of the antimalaria activities of the Alabama State Board of Health in 1924, will be available in February or March of 1925. The purpose of the sub-committee will perhaps be best served by a concise statement of the administrative features of the work under the headings assigned to it by the National Malaria Committee.

Only one community in Alabama adopted antimalaria measures in cooperation with the State Board of Health in 1924. This was the City of Selma, in Dallas County, which entered into an agreement with the state through the County Health organization after a study had been made of the malaria situation, at the request of the local officials. By the terms of this agreement the City Council and Board of County Commissioners appropriated jointly the sum of $10,000 for a malaria and mosquito control campaign to be directed by an engineer from the State Board of Health, whose services were without cost to the city and county. The attention of one regular city inspector was assigned to the campaign.

Work was begun in May, 1924. It consisted of drainage projects for a series of ponds, some of which were within the city limits, others immediately outside the city but within flight range of certain sections; filling of certain areas by diversion of city waste to this purpose; malaria investigations of the residents of infectible areas; education of citizens by means of moving picture shows and newspaper articles in methods of malaria control by screening and standard treatment; use of oil or paris green on suitable areas; house to house inspection for the control of the pest mosquito.

In August a report filed by Mr. C. C. Kiker, Assistant Sanitary Engineer, gave the following figures to show how the $10,000 appropriation had been spent up to that date:

Purchase and operation of truck	$ 530.72
Tools, lumber and equipment	471.10
Pipe	1,164.99
Labor	3,561.77
Foreman	448.55
Inspection	732.44
Oil and distribution	478.87
Incidentals	38.85
Total	$7,427.29

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This amount may be divided and charged to the two general classes of work as follows:

Malaria Control (drainage)	$5,950.62
Pestiferous Mosquito Control	1,476.67
Total	$7,427.29

In October the following was reported:

"All of the ponds formerly existing in the City of Selma and its immediate environ have been drained.

"The work that has been done in and around Selma has been a cleancut 99 per cent job. The engineering has been of the highest order, the local cooperation excellent. There are funds left over from the estimate on the original plans which should be applied to correction of places in the county."

The fact that only one city government as such, adopted anti-malaria measures in 1924, is accounted for by the administrative policy of the State Board of Health which adheres strongly to the plan of conducting malaria control work through the county health units wherever a local organization exists.

For this purpose three sanitary engineers from the State Board of Health are available at the request of county health officers for preliminary investigation work and for making surveys and establishing grades for drainage projects. The health officers are then advised as to the best methods of malaria and mosquito control and the various projects throughout the county are conducted under the direction of the county health officers.

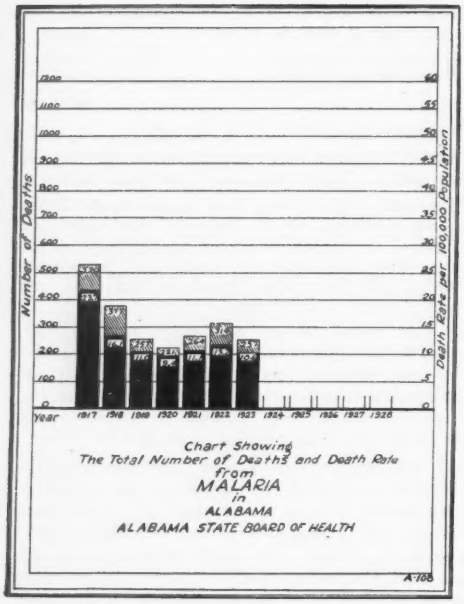
Twenty-three counties, comprising 38.4 per cent of the total area of the state and supporting 56 per cent of the total population have been thus assisted in handling their malaria problems during 1924.

The outstanding points studied and activities conducted by counties are reported to the State Board of Health by the County Health Officers under the following headings:

Lin. Feet of New Ditching
Lin. feet Ditch Maintenance
Breeding Area Corrected by Ditching (Acres)
Approximate Square Feet Oiled (or Paris Green)
Breeding Area Corrected by Oiling or Paris Green (Acres)
Approximate Cost of Work Indicated Above
Population Living in Infectible Territory
Approximate percentage Homes this Area in Some Measure Screened.
Square miles Malarious Territory
Number known Erdemic Malaria Foci
Places stocked with Gambusia
Number of Newspaper Articles on Malaria
Number Pieces Malaria Literature Distributed
Number of Pupils Taught Malaria (In addition to "Southern Supplement")
Number Malaria Lectures (of these———were in schools)
Number Attending Malaria Lectures
Number Field Demonstrations
Number Attending Field Demonstrations
Number Malaria Exhibits
Number Attending Malaria Exhibits
Number of times Malaria Film Shown
Number People Shown To
Remarks: (Note anything of interest)

MALARIA SURVEYS AND DEMONSTRATION OF ANTIMALARIA WORK IN SUITABLE COMMUNITIES

In addition to the surveys made and the county wide demonstrations of antimalaria work in the organized



counties, malaria investigations were made in and around mill plants in counties not organized for full time health service. This work was undertaken by a man detailed to the State Board of Health by the United States Public Health Service.

The communities in non-health unit counties, as well as in the organized counties which have been selected for special study and demonstration are those adjacent to impounded waters.

The magnitude of this work can best be illustrated by stating the amount of money that has been, and is being spent in Alabama for construction of hydro-electric plants: figures given in round numbers for construction work at Muscle Shoals by the United States Government are one hundred million dollars: Mitchell Dam, Alabama Power Company, eight million dollars; Cherokee Bluff, Alabama Power Company, ten million dollars; Barlett Ferry, Columbus Electric Company, seven million dollars; Gantt, Projects One and Two, River Falls Power Company, five hundred fifty thousand dollars; City of Dothan Power Company, one million dollars. There are several small projects, which have been given attention. The results obtained in these studies have been very interesting. The marked increase in the production of quadrimaculatus during the breeding season on these ponds is one most worthy of note.

Our first step in control consists in a request by the power company for a permit to impound the water; the second, a survey of the basin; the third, issuing a preliminary permit; the fourth, a malaria survey of the inhabitants living within flight range of the pond; the fifth, the basin is required to be cleared of all timber and other floatage and vegetation. These regulations apply to small ponds as well as to large impounded waters. Latitude in the enforcement of the regulations is permitted to the Board. When the conditions specified in the preliminary permit have been complied with, the water is permitted to be impounded.

The methods of control, after the impounding of the water, consists in stocking the pond with top minnows, stranding the driftwood and floatage by direct methods, and by lowering and raising the pond, and oiling the pond whenever anopheles breeding is found. This is done by installing a tank in a boat, filling the tank one half full of oil, then pumping the tank full of air, thus placing the oil under high pressure, and then by means of a nozzle attached, a high pressure spray is obtained, which is most effective. The spray breaks into a film when it strikes the water. Working with the wind the oil can be thrown two hundred feet. This method is the result of necessity. Mr. Albert Killebrew, Manager of the Houston Power Company, Newton, Alabama, who had built a pond before the regulations were effective, found himself faced with the necessity of controlling mosquito breeding, and assisted by Dr. T. H. D. Griffitts, of the United States Public Health Service, evolved this spray tank.

Wherever malaria has developed, we have used the standard treatment of quinin. In some instances we have distributed the quinin free, and in other places, we have provided it for the people at cost. We have advised the executives of every project to use quinin as a prophylactic measure among all of the people who come to work in the basin before the waters are impounded, and upon all the population immediately contiguous to the impounded waters, who have been found to be carriers of malaria.

The control of malaria around Mitchell Dam, a project of the Alabama Power Company on the Coosa River, has been almost one hundred per cent. With the shoreline aggregating two hundred sixty miles, there have been during the year five cases. We have been able so far to control these cases, so as to prevent the spread.

Altogether field investigations have been made and anti-malaria measures put in operation in thirteen non-health unit counties. This brings the proportion of the total area of the state benefited by malaria control measures to 57 per cent.

COOPERATIVE EFFORT IN MALARIA WORK

The state program for the control of malaria in Alabama is the result of cooperation by the United States Public Health Service and the International Health Board with the Alabama State Board of Health. The former makes available the services in an advisory capacity of the medical officer in charge of malaria investigation, the services of an epidemiologist and an assistant sanitary engineer for field investigations. In addition to these an assistant surgeon to make epidemiological studies of malaria in Alabama has been almost continuously assigned to this field.

The International Health Board has supplied one half the salary of two assistant sanitary engineers for service in connection with the county health units and also contributes valuable council with regard to administrative problems.

A conspicuous example of cooperation in field activities was carried out in the government reservation at Muscle Shoals where a microscopist was employed by the United States Public Health Service; two medical assistants by the International Health Board; motive equipment, quinin and the services of one sanitary engineer were furnished by the State Board of Health, while the cost of operating the malaria control measures on the lake was borne by the War Department.

An effort toward cooperation between the State Agricultural Department, Extension Service, and the State Board of Health, was occasioned by the passage some years ago of an agricultural drainage law. Several drainage projects were worked up by the state agencies. These have all been held up because of a decision of the Supreme Court, calling into question the constitutionality of this law. The case is still in the hands of the court.

A constitutional amendment was passed on November 4, 1924, authorizing the formation of drainage districts in the interest of improved agriculture and public health. The resumption of activities under a new law will afford further opportunity for a demonstration of the cooperation of several state agencies in field activities for malaria control and agricultural improvement.

MALARIA CONTROL ACTIVITIES IN ARKANSAS*

By M. Z. Bair,
Chief Sanitary Engineer, State Board of Health,
Little Rock, Ark.

Our malaria control program for the past year has consisted in carrying forward our urban units and doing as much as we could in connection with county control work.

We have been rather slow in getting our county work under way. The primary reason is the low density of population and the proportionately high per capita cost. We have been unable to organize full-time county health units except in a few counties. However, considerable educational work has been done in the counties with a view of ultimately getting full-time units.

We have two counties which will undertake the work, two definitely committed to it, and one which is practically committed to it, but it is not official. They are the more densely populated counties. Programs have been tentatively planned for them and we feel that a sufficient amount of money can be raised to do effective work. However, many of our counties, especially in the eastern portion of the state, are in the same class as those referred to by Dr. Rankin, very sparsely populated, which, together with the absence of drainage, makes it a difficult and costly problem. A large proportion of the tenant houses are most difficult to screen. In fact, it is more than just a screening proposition. It is almost a reconstruction problem, so far as the houses themselves go.

We have held our old urban units and added a number of new ones, greatly increasing the urban population protected. The results secured have been very satisfactory.

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MALARIA CONTROL ACTIVITIES IN GEORGIA*

By M. A. Fort, M.D.,
State Board of Health,
Atlanta, Ga.

In Georgia we have about eighteen counties doing county health work under the direction of Dr. Waller. In three of those counties there are one medical officer and three non-medical officers, making four officers in the three counties. They are specializing upon malaria.

They are doing principally, quininization, and encouraging screening, and trying to get some drainage done. The United States Public Health Service and the State Board of Health pay one half of the expense, while the counties pay the other half. This is the only proposition of the kind which the State Board assists in a financial way.

We are in a state that has only three cents per capita appropriation for all health work, laboratories and everything else. I think most of you have two or three or five times as much as that.

We have been trying for years to get an appropriation for anti-malaria work. We haven't a cent yet, so we are trying to fight malaria without a cent for the purpose. Our sanitary engineers, of course, do what they can.

Last year I went from county to county making talks in the principal schools, and explaining, exhibiting larva, charts, pictures, and distributing literature. I have been over the whole malarial part of the state that way in almost every school.

This year we felt the need of concentrating a little more, so I adopted the method of examining the spleens. Now I go to every school in the county and examine every child in the school under 12 years of age. They

*Report from Member of Sub-Committee on Administration, National Malaria Committee, (Conference on Malaria), meeting conjointly with Southern Medical Association, Eighteenth Annual Meeting, New Orleans, La., Nov. 24-27, 1924.

often become so interested that all the boys insist on being examined, and parties of the girls at recess, 12, 14 and 16 years old, insist on being examined, and in some cases the teachers as well.

I make a complete record, with a carbon copy. If I find an especially large spleen in a little fellow, I call the teacher over and let her feel it. Of course her ideas are vague, but when she feels a hard mass coming three fingers breadth below the ribs, she becomes interested and is a good missionary. I leave the teacher a record sheet of the examination, and with that as a text we succeed in having many standard treatments taken.

Two years ago in my rounds, the children told me things like these: "We get malaria from dirty ponds, night air, sugar cane, fish in stale water, watermelons in dog days, flies and mosquitoes raised in weeds, pea vines, trees." Now almost any school in the malaria belt will tell you about eggs, larvae, pupae, mosquitoes, how they get malaria, how they transmit it, and the essential facts about draining, screening, oiling and quininization. We are rapidly growing a population that will demand health appropriations large enough to do some practical prevention.

We arrange for standard treatments at cost. Some health officers have a fund for buying quinin at cost, selling it at cost and buying more. We are now having one hundred five-grain capsules sold for one dollar.

Incidentally, as I go through these schools I pick out particularly bad cases of adenoids, the worst cases of hook-worm, and other defects. I have the teacher who makes the list, make a note under "Remarks." In this way some other corrections are made.

Our last plan of work is to teach from the theater.

The difficulty in getting an adult audience has led me to write a little comedy called "The Country Cut-Ups," embodying my most humorous experiences in health work. A health officer visits a rural school and finds an antagonistic audience of parents objecting to the examination of their children. How he overcomes their prejudices and teaches them the principal facts of preventive medicine forms the theme. The school comedians keep the interest keen, and between acts I always get a chance to hammer home local needs to a large audience. If they will not listen to me I make their children teach them.

MALARIA CONTROL ACTIVITIES IN LOUISIANA*

By OSCAR DOWLING, M.D.,
State Health Officer,
New Orleans, La.

While we are not satisfied with our malaria control activities, we have reason to feel that a good impression has been made throughout the State and that a large number of communities adjacent to the towns in which the work has been carried on, likewise parishes adjacent to those where the United States Public Health Service investigations have been made, will take up the work in another year.

Summarized, we find that during 1924, surveys and cost estimates were made for three towns, Merryville, Grand Cane and Vivian, and a proposed real estate subdivision near Shreveport.

Supervisory assistance was furnished for ten local control campaigns as follows: Natchitoches, Baton Rouge, De Ridder, Homer, Haynesville, Mansfield, Minden, Ludington, Bon Ami and Ruston.

Four communities in addition to the above, Monroe, Lake Charles, Elizabeth and Shreveport, carried on campaigns.

Malaria investigations were made in two parishes by the U. S. Public Health Service. These parishes are St. Mary and Tangipahoa.

Early in the summer we determined that the time had come for an intensive malaria educational program. With this in mind the Superintendent of the Department of Education was sent a copy of Dr. Carter's very excellent article on Malaria, published by the United States Public Health Service, and Mr. Harris agreed that it was worth while to have this taken up wherever the Parish Superintendents would like to do so in the schools. It is not obligatory, but is named by the State Department of Education as a Supplementary Reader and no doubt many of the teachers will use the Malaria Primer very effectively. We have had a large number of requests so far for this little book. It is our purpose to assist financially in this work by supplying the Primer in quantities to the Superintendent of Parishes or principals of schools, so that they may be had by any teacher who will take the initiative in this form of malaria education.

We have issued from time to time about 15,000 leaflets on malaria, those by Dr. Bass and some that were prepared by the members of our own force.

Beginning with January 1, we expect to make an earnest effort to give supervisory assistance to communities asking for it, and to assist otherwise communities that desire to put on malaria programs.

The malaria death rates in Louisiana, 1918 to 1924, inclusive, are as follows:

1918	28.75
1919	24.56
1920	33.95
1921	23.22
1922	21.82
1923	16.65
1924	14.81

Estimated from number of deaths reported to September 30, 1924.

*Report from Member of Sub-Committee on Administration, National Malaria Committee (Conference on Malaria), meeting conjointly with Southern Medical Association, Eighteenth Annual Meeting, New Orleans, La., Nov. 24-27, 1924.

MALARIA CONTROL ACTIVITIES IN MISSISSIPPI*

By F. J. UNDERWOOD, M.D.,
State Health Officer,
Jackson, Miss.

General.—At the close of the year 1923 there were three counties and twenty-seven municipalities recorded which carried on malaria control work during that year.

During the first quarter of 1924 three counties, Jones, Washington and Yazoo, continued active control work. Fourteen municipalities had notified the State Health Department of their intention to continue malaria control work. The amounts set aside by these towns ranged from $75.00 to $2000.00, only two towns appropriating less than $500.00 for the season's work.

By the time active malarial transmission could be expected there were 30 towns recorded as conducting work directed toward the control of malarial fever and mosquitoes in general.

COUNTY-WIDE PROJECTS

Jones County.—The work in this county was instituted and carried on by the International Health Board in 1923, and was continued in 1924 under the general supervision of the International Health Board in connection with the director of the full-time county health unit established with the beginning of this year, and formed part of the regular county health program.

The following statistical data, covering a five year period, are offered for this county:

TOTAL MALARIA CASES REPORTED BY PHYSICIANS
JONES COUNTY, MISSISSIPPI
(By Yearly Quarters)

	1920	1921	1922	1923	1924
1st Quarter	180	146	98	61	66
2nd Quarter	291	309	144	157	158
3rd Quarter	417	308	189	233	192
4th Quarter	248	118	164	90	
Total	1136	881	595	541	
Per cent physicians reporting (Annual average)	97.5	99.6	100.0	100.0	91.8

Washington County.—This county supports a full-time health unit, and in 1923 malaria control became an added feature of the unit's activities, a separate budget, cooperative with the State and International Health Board, being available for the work. A sanitary engineer of the State Board of Health was detailed to direct the malaria control work, working in cooperation with the director of the health unit.

This same plan was continued in 1924, the program consisting largely of educational work, featuring the proper screening of dwellings and such buildings where people gather.

The following statistical data, covering a period of five years, are offered for this county:

TOTAL MALARIA CASES REPORTED BY PHYSICIANS
WASHINGTON COUNTY, MISSISSIPPI
(By Yearly Quarters)

	1920	1921	1922	1923	1924
1st Quarter	228	255	263	209	250
2nd Quarter	617	701	621	578	595
3rd Quarter	1382	1502	1346	1153	933
4th Quarter	699	573	512	511	
Total	2926	3031	2742	2451	
Per cent physicians reporting (Annual Average)	98.8	100.0	100.0	99.0	100.0

For the year to date (January to September inclusive) compared with a like period in 1923 there is indicated a reduction of 8.3 per cent in malarial cases reported by the physicians of this county.

Yazoo County.—In the spring of 1922 county-wide malaria control work was undertaken in this county with the view of determining the effectiveness of such an undertaking by using small budgets.

The work has been continued uninterrupted for the past three years, the working budgets having been as follows: 1922, $1,000.00; 1923, $3,300.00; 1924, $3,330.00. The expenditure in 1922 was $862.86; 1923, $3,028.42. For 1924 the total expenditures will be approximately $2,200.00.

During the entire three years the International Health Board and State Board of Health rendered financial aid. The work was directed by a sanitary engineer of the State Health Department.

During the first year of work the United States Public Health Service rendered invaluable aid to this county by detailing a medical officer who in connection with other investigational work carried out an educational program.

The entire program was based upon the fact that to control malaria it was necessary to know the distribution of the disease within the territory under consideration, and to employ such practical control measures as would suit the various situations encountered.

In support of such a program, conducted over a three year period, the following comparative statistical data are offered:

TOTAL MALARIA CASES REPORTED BY PHYSICIANS
YAZOO COUNTY, MISSISSIPPI
(By Yearly Quarters)

	1920	1921	1922	1923	1924
1st Quarter	508	402	413	336	146
2nd Quarter	1041	766	667	549	329
3rd Quarter	2180	1670	1687	1602	612
4th Quarter	981	872	670	527	
Total	4710	3710	3437	3014	
Per cent physicians reporting (Annual Average)	97.3	100.0	100.0	100.0	99.4

For this year to date (January to September inclusive), compared with a like period in 1923, there is indicated a reduction of 56 per cent in malarial cases reported by physicians.

*Report from Member of Sub-Committee on Administration, National Malaria Committee (Conference on Malaria), meeting conjointly with Southern Medical Association, Eighteenth Annual Meeting, New Orleans, La., Nov. 24-27, 1924.

All full-time health units in the state, 8 in number, carried on some measures of malaria control during the year.

Financial aid was rendered only to the county-wide projects already mentioned. Advisory aid was at all times available to municipalities and the individual, and was freely given through the State Division of Malaria Control.

STATISTICAL

(State of Mississippi)

The following data are offered which indicate the course malarial fever has taken in the state at large over a five year period.

TOTAL MALARIA CASES REPORTED BY PHYSICIANS STATE OF MISSISSIPPI

(By Yearly Quarters)

	1920	1921	1922	1923	1924
1st Quarter	11567	11884	11120	9289	9424
2nd Quarter	22292	23846	25292	19787	21154
3rd Quarter	56547	57808	51313	46764	34236
4th Quarter	27970	27673	20022	19382	
Total	118376	121207	105747	95222	
Per cent physicians reporting (Annual Average)	94.4	96.2	96.4	96.1	96.2

Reviewing the above figures and comparing the cases reported for the first nine months of the current year with the same period of the preceding year, it is noted that there is a reduction in cases reported of 14.4 per cent for the state at large.

Prior to the month of August the number of cases reported was slightly in excess of last year's record.

LABORATORY EXAMINATIONS FOR MALARIA

The encouraging of definite diagnosis of malarial fever has formed part of the plan to control this disease.

The following table indicates the use that is being made of available laboratories to confirm malarial diagnoses:

BLOOD SMEARS FOR MALARIA (1924)

	Total Exam.	Total Positive	Per cent Positive
First Quarter			
State Hygienic Laboratory	609	12	1.97
Bolivar County	802	141	17.58
Coahoma County	142	7	4.93
Forrest County	26	0	0.00
Jones County	12	0	0.00
Lee County	25	0	0.00
Tallahatchie County	6	1	16.67
*Yazoo County	109	1	0.92
TOTAL	1731	162	9.36
Second Quarter			
State Hygienic Laboratory	886	45	5.08
Bolivar County	1446	647	44.74
Coahoma County	275	29	10.55
Forrest County	87	13	14.94
Jones County	43	2	4.65
Lee County	33	4	12.12
Tallahatchie County	125	12	9.60
*Yazoo County	79	9	11.39
TOTAL	2974	761	25.59
Third Quarter			
State Hygienic Laboratory	1132	47	4.15
Bolivar County	1996	801	40.13
Coahoma County	362	42	11.60
Forrest County	137	9	6.57
Jones County	100	2	2.00
Lee County	118	32	27.11
Tallahatchie County	130	12	9.23
*Yazoo County	41	6	14.63
TOTAL	4016	951	23.68
Total for Year to Date	8721	1874	21.49

The foregoing table includes only information which is available from reports rendered to the State Board of Health.

*Yazoo County has a part-time health officer employing standard full-time personnel. All other counties recorded have full-time health departments.

EDUCATIONAL

There is no doubt that the gradual lessening of malaria cases in the state is due in no small measure to the educational work done in public schools and normal schools; through the press and state health department literature, and by the various means used by personnel engaged in controlling the disease.

Prior to the present year literature pertaining to malarial fever offered by the State Board of Health, consisted of but one small pamphlet rather technical and above the ready understanding of the average person whom it was desired to reach.

During the year three circulars and one bulletin were prepared and distributed.

Circular No. 1 is in the form of an advisory notice and explains the protective measures which are advisable when it is inadvisable to institute general control measures. This circular was mailed to road builders, railroads, engineering firms, and others who are required, in the pursuance of their work, temporarily to spend time in low-lying swampy areas.

Circular No. 2 outlines the menace of roadside borrow-pits from the standpoint of malaria dissemination. Copies were mailed to all known persons in Mississippi who are engaged in work which might require the borrowing of earth, and to each railroad operating in the state. Letter requests were received from 16 railroad offices for this circular.

Circular No. 3 deals with mosquitoes, and by use of a simple outline segregates the breeding areas, character of breeding which might be expected from each area, and a practical control measure which applies to each area.

Health Bulletin No. 22 entitled "Malaria and our Friendly Enemy the Mosquito" is prepared in non-technical language setting forth clearly the habits of those mosquitoes of importance to us, and the general facts relating to malarial fever. Its preparation is such that it is valuable for school use.

At the present time another malaria bulletin is in preparation and about ready for the press.

No opportunity has been neglected to further the use of the standard quinin treatment, and in particular the continuance of treatment until a cure is effected. Where this was done in connection with control work a marked increase in the sales of quinin sulphate was noted and a decided decrease in the sales of chill tonics. Efforts

to have quinin available for purchase in plantation commissaries and cross-road stores have also been successful.

MAN MADE MALARIA

Special attention has been given to the creation of artificial anopheles breeding areas. Many persons engaged in highway construction were cautioned regarding the digging of borrow-pits left undrained, and Federal and State Laws affecting such violations made known to them. Several railroad companies were dealt with relative to anopheles breeding areas created by them along the right-of-way, and State Laws affecting such health nuisances were brought to their attention. Every railroad operating in Mississippi, and every Board of County Supervisors in the State, a number of individual contractors, and the State Highway Department have been requested to give particular attention to the proper drainage of borrow-pits, and advised of existing laws affecting the creation of mosquito breeding areas within the State. Most encouraging results have been noticed.

CLIMATOLOGICAL CONDITIONS

The entire mosquito season was relatively free from rainfall, the total departure from normal for the first nine months of the year being minus 9.02 inches, and for a like period last year the total departure from normal was plus 11.94 inches, which gives 20.96 inches of rainfall less for the period in 1924 as compared to 1923.

It is noted that of the 9.02 inches of rainfall below normal 7.37 inches fell during the third quarter of the year.

Just what bearing the lack of rainfall has had on the trend of malaria in the State is difficult to say, and it is also speculative as to the effect the dry weather of this year will have on the disease next year.

1925 PROGRAM

The distribution of malaria by counties throughout the State of Mississippi is generally known.

The personnel employed on malaria control work this year consisted of two men, each conducting a county-wide control project. In addition one of the men served as Director of Malaria Control, looking after all projects requiring investigation and advisory aid, and handled the detail work in the central office.

For work in 1925 it is planned to increase the state malaria control personnel to four men, one to serve as state director and the remaining three to carry on work in counties which have full-time health units, and a malarial problem of sanitary importance.

Before instituting control measures a study of the distribution of the disease throughout the county will be made. This knowledge is considered as absolutely necessary before effectively directed control measures can be undertaken. Such work will be carried on in a predetermined systematic manner. The director of the full-time unit is considered to be in charge of all health work in the territory under his jurisdiction, and should malarial fever present a problem of sanitary importance to his people it is considered to be his duty to give this disease the consideration which it warrants.

Where malaria is of sanitary importance it presents a large and difficult problem, and aid from the state health department is most essential to assist in studying the problem to determine the most effective method for handling it.

It is not profitable, nor is it wise, to make hasty surveys depending upon morbidity data and information picked up at random. Such methods, when practiced, result in a waste of time and money, and are almost certain to produce dissatisfaction among the local populace should inadequate control result therefrom, which can hardly otherwise be expected.

It is known that malaria is hardly ever evenly distributed throughout a district in this country. Even in the extremely malarious sections "spots" are to be found where there is little or no malarial fever.

Before instituting control measures the problem must be investigated and studied. Data collected from investigational work will be extensive and can be best used if symbolized, and the work directed from maps and charts thus obtained.

The county must necessarily be divided into districts and each district subdivided. By progression the extent of the malarial problem must be determined in each subdivision, district, and county as a whole.

Such survey work should extend through an entire year embracing all the seasons as the problem will present different aspects during the several seasons.

Such is the program planned for 1925. Working in cooperation with directors of full-time health units, sanitary engineers of the state health department will make the surveys, map the districts, record all data, and from the information secured, work out a practical control program. It is readily seen that such procedure will determine the extent of the problem, the foci of infection, the practical means of control that can be employed, and indicate how the problem should be handled to gain the most for the least possible expenditure.

Large sums of money are not thought necessary for the control of malaria, even in the delta section of Mississippi. With accurate information, which can be intelligently interpreted, showing the distribution of the population, the productive areas of anopheles and other pertinent information, an annual working budget of a few thousand dollars will suffice to control this disease, provided the work is systematically carried on uninterrupted over a period of years.

During the period when investigational surveys are being made, intensive educational work will be carried on.

The control of malaria is largely a problem to be solved by the people affected. The 1925 program also includes having the individual to do certain work which is clearly his responsibility, for the protection of those persons affected by conditions existing on his premises.

MALARIA CONTROL ACTIVITIES IN MISSOURI*

By CORTEZ F. ENLOE, M.D.,
State Health Commissioner,
Jefferson City, Mo.

The following brief summary of our malaria problem I believe will assist in giving a better understanding of our condition and an evaluation of our activities. Malaria in Missouri is not a state-wide problem, but is confined properly to several counties in the southeast section of Missouri commonly known as Southeast Missouri. Localized outbreaks occasionally occur in the adjoining hill counties, but these are not endemic foci of infection. Infection is brought to these sections by cotton pickers returning from the lowland and these constitute the bulk of cases. Occasionally, however, an outbreak will occur in other portions of the population but it usually wears itself out in a season without any organized effort at control. The seven southeast Missouri counties, known as Southeast Missouri, are practically all reclaimed swamp lands. Prior to the beginning of drainage operations in 1907 the land was sparsely settled except for a few ridges which were quite densely populated. As drainage progressed the timber was cleared and the land put under cultivation. At first general farming was the main pursuit, but of late years it has been transformed into a cotton growing country. Drainage operations were temporarily halted by the war and the agricultural depression which followed. These operations have again been resumed. The State Board of Health began its anti-malaria activities in this section in 1921, at which time a survey was made of representative sections of this area. The Public Health Service and the International Health Board assisted in financing the survey and also supplied two malaria epidemiologists. A program of control must embrace the following activities: (1) Further drainage of the undrained areas; (2) control of the St. Francis River and (3) ditch maintenance. These alone in the end will eradicate malaria. However, they can be hastened and augmented by control of the individual and his immediate environment. These latter activities can be carried on only through some existing local health organization, preferably a county health department.

ADOPTION OF ANTI-MALARIA MEASURES BY A COMMUNITY

Several new drainage districts have been organized and drainage operations are rapidly progressing. In a large measure these are for agricultural purposes but I believe it is safe to say that our educational work in malaria control has been quite a factor in hastening the work. The St. Francis River remains a problem difficult to solve. Firstly, it has been declared a navigable stream and is under the control of the War Department. Secondly, it is too large a problem to be handled by drainage districts; and lastly, it will involve some legislative action on the part of both Missouri and Arkansas. The situation so far as Missouri is concerned, has been improved by the digging of a ditch on the Arkansas side. Through some fortuitous circumstance the main waters of the St. Francis River have been diverted into this ditch thereby partially solving our problem. A ditch maintenance fund has been advised by the State Board of Health for several years, but until recently we could not obtain any results, the reason in part being that most ditches were new and as yet had not become overgrown with vegetation. The main reason, however, was that those sponsoring drainage projects advised local authorities to spend available money on ditch construction and leave maintenance for the future. The Little River Drainage District, the largest drainage district, has been reorganized and refinanced. The plans call for an expenditure equal to the original investment. Most of this amount will be spent for ditch maintenance and for the building of smaller laterals. Another large drainage district has recently created a ditch maintenance fund and they are making some progress towards the clearance of ditches. As a result of our work three full-time county health departments were organized in 1921, two of which are still in operation, but one of which was discontinued at the end of its first year of operation. A fourth county now has the proposition under advisement and we expect its appropriation before the first of the coming year. Sentiment is rapidly growing in the fifth county and undoubtedly this county will be organized within another year. The health officers in our full-time counties experienced great difficulty in developing sentiment for malaria control, the reason being that the reduction had been very great following the construction of the ditches and the citizens believed the problem would ultimately be taken care of through this means. Educational work was about all we could do for the first year. In all of the schools malaria courses were given, using Carter's Primer as a text.

MALARIA SURVEYS AND DEMONSTRATIONS OF ANTI-MALARIA WORK IN SUITABLE COMMUNITIES

The preliminary survey mentioned above was conducted in 1920, abstracts of which appeared in the Journal of the American Public Health Association and the Public Health Reports. In addition, the health officers sent questionnaires to families and practicing physicians to determine the actual cases. Spleen and blood examinations of the school children are now in progress. Soon we will have a true index of the present conditions. During the winter and next summer we propose to carry on local farm drainage work and other local control activities. The local health officers have by means of dipping and mosquito identification fairly well outlined the principal breeding areas. They have induced most of the druggists to stock standard quinin treatment, which is being dispensed to patients practically at cost. The local practicing physicians are

*Report from Member of Sub-Committee on Administration, National Malaria Committee (Conference on Malaria), meeting conjointly with Southern Medical Association, Eighteenth Annual Meeting, New Orleans, La., Nov. 24-27, 1924.

aiding the health officers in popularizing this remedy. One county health officer has dispensed free of charge, a limited amount of quinin through his office. He has induced a large number of plantation owners to dispense this remedy to their tenants. The county farm agents are cooperating in bringing about local farm drainage and stocking ponds with top-feeding minnows.

COOPERATIVE EFFORTS AT MALARIA CONTROL

The hardware dealers are recommending and pushing the sale of 16-mesh screen. We have no exact figures on the amount of improvement in screening, but it has been estimated at about 50 per cent. The accomplishments in the creation of a ditch maintenance fund has already been mentioned. Other districts are showing interest in this activity and we believe they will follow the lead that has been taken. Two towns have adopted local control measures. One is fostered by the Lions Club and the other by the city council. A demonstration is being conducted in the creosoting of tenant houses. If this proves successful, there is no reason why it cannot be extended to the majority of tenant houses in the area. We expect to carry on this work intensively during the coming year. The State Board of Health has established a central public health laboratory at Jefferson City where we are doing slide examinations for the local health officers and practicing physicians. It is our intention to establish a branch laboratory near this malarious region during the coming year and thereby further stimulate the use of the laboratory as a means of diagnosis. In the past the laboratory as a means of diagnosis was used very little. Continued fevers were given the therapeutic test and if they failed to respond to quinin they were called typhoid fever. Practically all chills were called malaria. We have employed an epidemiologist who is giving a good portion of his time to studies in this area and he has already made great progress toward the discovery of individual foci of infection and stimulating local interest in eradicative measures. A questionnaire is being sent to every physician reporting a malaria death. This questionnaire in brief asks for complete data on which the diagnosis of malaria was made.

SUMMARY

Our malaria problem is confined to a small area of Missouri known as Southeast Missouri. This is practically all reclaimed swamp land. The principal items in our control program embrace the following: (1) further drainage of swamp lands; (2) control of the St. Francis River; (3) maintenance of the ditches already constructed and those to be constructed. This program can be made more effective and be given greater application by further control of the individual and his immediate environment. For the purpose of bringing this about and promoting general health we are organizing full-time county health units in this area. The United States Public Health Service and the International Health Board are assisting us in the organization and maintenance of these departments. Through these units we are conducting the following activities: (1) Education, (2) detailed epidemiological studies to find out existing foci of infection and carrying out such measures of control as screening, quininization, creosoting of houses and individual farm drainage. At present our central laboratory at Jefferson City is providing laboratory service for this area. We propose to start a local branch laboratory which will do more intensive laboratory work on malaria.

MALARIA CONTROL ACTIVITIES IN NORTH CAROLINA*

By W. S. RANKIN, M.D.,
State Board of Health,
Raleigh, N. C.

We are carrying seven counties in North Carolina on our malaria program. These counties go in on a two year plan, with a total appropriation of $10,000 each. That is about $70,000 a year. Next year we shall continue to carry seven counties. All the counties that do the work go into it with a full time department.

While I spoke earlier today rather discouragingly as to definite results obtained in this work (questions of that sort having been raised by Dr. Ferrell, not by the counties themselves), I think the counties are thoroughly satisfied. Two years ago when one of the counties went into the program, the man who had more influence politically there than any one else, opposed it. He was elected in November to Congress. He went to the health officer this year without solicitation and without expecting anything in the way of return, as he had been elected, and said:

"If I can do anything for you this year I would like to go before the county commissioner and advocate this program. I have been sold to the work." That is indicative of the feeling of the people in the counties.

MALARIA CONTROL ACTIVITIES IN SOUTH CAROLINA*

By JAMES A. HAYNE, M.D.,
State Health Officer,
Columbia, S. C.

There are fourteen counties in South Carolina with fully organized county health departments. In ten of these counties there is a malaria problem. The other four are more fortunately situated.

It has always been difficult to induce the county health officers to undertake malaria control work on a county-wide basis. The reason for this attitude is somewhat obscure. We believe it is due to the fact

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that county-wide malaria control work is very much more difficult than vaccinating school children, giving typhoid fever inoculations, or making health talks to schools.

In some counties a prejudice exists against referring to the fact that malaria is present in the county. The people who feel this way about it realize that the presence of malaria is economically damaging to the community. They realize that malaria has given the county a bad reputation, and feel that any attempts to eliminate it must perforce be accompanied by an admission that malaria exists. This indifferent attitude on the part of the health officer has been overcome in some of the counties by setting aside a specific portion of the budget for malaria control work, with the understanding that a portion of the time of the health organization is to go to the solution of the rural malaria problem. To overcome the attitude of the county health officers in those counties where financial assistance is not given to the county budget with the express understanding that malaria control work is to be done, it is planned to hold one or more monthly conferences during the year, devoted entirely to discussing practical methods for solving the rural malaria problem.

In the three counties where assistance is given to the county budget to do malaria work, encouraging results have been obtained, although the work was late in getting started. The fact that we had collected information through the schools during the preceding school term with reference to the distribution of malaria in the county, made it easier for the county health officer to locate the foci of infection in the country districts, so that all of his time devoted to malaria could be spent in applying malaria control methods to areas most in need of them.

South Carolina is attempting to maintain a county health organization in one of the poorest counties in the state, where the population is less than 19,000, and three-fourths of these are negroes; leaving barely 5,000 white people to carry the burden. This is a concrete example of the white man's burden. We feel that if a success can be made in this county, the county health organization can succeed anywhere. We are at present by no means certain that success will attend our efforts, particularly since there have been three successive crop failures in this section of the state, and the county is in danger of losing still more of its white population.

In other sections of the state where conditions are better, and where some malaria exists, our experience has been that the conditions causing malaria are much more easily remedied. These counties do not have the extensive swamp areas that other counties have. The per capita wealth is higher, and the wealth is more equitably divided than in the more malarious counties having so large a percentage of the negro population.

MALARIA CONTROL ACTIVITIES IN TENNESSEE*

By C. B. CRITTENDEN, M.D.,
State Department of Public Health,
Nashville, Tenn.

The major malaria belt in Tennessee lies between the Mississippi and Tennessee rivers in the western division of the state. At present there are no state funds available for aiding in this work except by the personnel of the Division of Sanitary Engineering.

Anti-malaria work in Tennessee as carried on by the State Department of Public Health, is under the supervision of the Divisions of Sanitary Engineering and of Rural Sanitation.

The former division functions by making original mosquito control surveys chiefly of towns and small cities, submitting recommendations and estimates of costs for the necessary remedial measures, and, in so far as time will permit, inspecting control and progress during the mosquito season.

A number of towns in west Tennessee where malaria control work has been done in the past through financial help from the State Health Department and other outside agencies, namely, the Federal Government and the International Health Board, have continued the work from year to year. After funds from cooperating agencies have been withdrawn, some of these towns, including practically all of any importance in west Tennessee, are: Covington, Millington, Dyersburg, Union City, Humbolt, Jackson and Martin.

Of special interest is the work being done in Shelby County where an active campaign has been in progress since the spring of 1923. A competent and progressive inspector is provided from local funds who has had the assistance not only of the State Health Department but of the Malaria Field Headquarters of the United States Public Health Service located in Memphis, as well. Interest has been maintained through the organization of the Shelby County Anti-Malaria Association and nearly every community in the county has been reached. A malaria school census has been made and the usual mosquito control measures have been instituted.

Other mosquito and malaria control campaigns in which the Division of Sanitary Engineering was interested were conducted at Columbia and Cowan. At the latter place assistance was given by the N. C. and St. L. Railroad which maintains a round house and machine shop, coal chute and freight yard at that place, and many of the population of which are railroad employes. A large amount of ditch draining was required which was done chiefly with dynamite. The cost of the work,

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which amounted to $7,500, was borne jointly by the following parties:

Tennessee State Health Department	$1,500.00
Town of Cowan	500.00
T. M. Stewart, owner of property with large pond	2,000.00
Five residents of Cowan, $100.00 each	500.00
Nashville, Chattanooga and St. Louis R. R. about	3,000.00
	$7,500.00

The malaria and mosquito work carried on through the Division of Rural Sanitation is accomplished by the full time county health units which are affiliated with that division. There are at present two counties in West Tennessee with full-time county health departments Gibson and Obion. In Gibson County a preliminary survey has been made, some general educational work carried on in connection with community organizations, and quinin distributed to cases of active malaria. In Obion County a school survey has been made, general mosquito control measures instituted, and general educational measures carried on.

MALARIA CONTROL ACTIVITIES IN TEXAS*

By MALONE DUGGAN, M.D.,
State Health Officer,
Austin, Tex.

Organized malaria control in Texas was first started in 1920 with the International Health Board, the United States Public Health Service, and State Board of Health cooperating in the formation of three units, each under the supervision of a sanitary engineer, and aggregating twelve cities with a population of approximately 40,000. The former two agencies contributed the directors and aided the cities directly by augmenting the funds raised locally. In 1921, the arrangement was continued on the same basis, the only change being the addition of several more towns to the units. The year 1922 saw the partial withdrawal of the cooperating agencies, and the assumption of some of the burden by the State Board of Health. This arrangement allowed only two field directors, one furnished by the State Board of Health and one by the International Health Board, and precluded any expansion, maintenance of the old towns being all that was attempted.

Early in 1923 the state legislature appropriated $17,500 to be expended in two years upon malaria control. This allowed expansion upon the solid foundation afforded by the demonstration units. Immediately more field directors were made available and the number of towns doing malaria control was increased to 30, doubling the number, and more than doubling the population protected. The second year in which the legislature's appropriation was available, 1924, saw a further increase to 70 cities doing malaria control and protecting a population of 900,000, or 60 per cent of the total urban population of the State.

This work was accomplished with a force of five engineers and inspectors who gave a part of their time to malaria control, and five students who were employed during the summer for the purpose of assisting the anti-malaria activities. The State's expenditures for 1924 were $10,000, plus $3,900 contributed by the International Health Board. All of these funds were expended on salaries and expenses of the field representatives, no assistance being offered to the towns other than advice and supervision.

The cost of malaria control to the cities amounted to a total of $54,951.00, a per capita cost of 6.1 cents. These costs may appear low to the workers in other states. However, Texas is favored by nature in several ways in the matter of mosquito control. As a whole, the country is well drained, swamps are few and major drainage operations are not necessary. The summers are dry, as a rule, thereby requiring less minor drainage and cutting oiling costs. It has been found cheaper to apply oil a few times in the spring and fall than to construct and maintain ditches and do extensive stream rechanneling.

Malaria control in Texas cities is complicated by the demand for the control of all mosquitoes. Particularly has this been true since the dengue epidemic of 1922. However, all anti-mosquito control campaigns conducted under the supervision of the State included efficient anopheles control. A city may be rated as obtaining mosquito control, but the "partial" applies to the pestiferous and dengue-carrying mosquitoes only, perfect anopheles control being required. Some cities, particularly the larger ones such as Houston and Dallas, direct the bulk of their anti-mosquito control work against anopheles.

The local organization that applied the anti-malaria measures was of course varied according to local conditions. Wherever possible the work was carried on under the supervision of a full-time inspector or foreman. Of the 70 cities, 22 were able to employ full-time men. In 10 cities the local health officer gave direct supervision. City marshals performed this duty in 8 other cities. In the balance of the cities mosquito control was carried out under the direction of a part-time man, usually a city employe, sometimes a meter reader, a street foreman, or city secretary. It has been found more conducive to continuation of the work from year to year to train a permanent city employe than to advocate the hiring of a man on a part-time basis for the summer only.

A comparison of the number of cases of malaria reported from the state as a whole indicates a downward trend of malaria, probably due to the extension of anti-malaria work. During the first eight months of

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TEXAS CITIES DOING ANTI-MALARIAL WORK

Town	Population	Type of Control	Cost of Work	Local Director
Waco	50,000	Complete	$ 5000.00	Full time
Dallas	175,000	Anopheles	7000.00	Full time
Waxahachie	8,000	Complete	1050.00	Full time
Ennis	7,000	Complete	175.00	Part time
Marlin	6,000	Complete	570.00	Full time
Mart	3,500	Complete	120.00	Part time
Gainesville	9,000	Complete	150.00	Part time
Denton	8,000	Complete	250.00	City health of.
Mexia	15,000	Complete	260.00	Part time
Terrell	8,500	Partial	160.00	Part time
Kaufman	3,000	Complete	200.00	Meter man
Wortham	2,500	Complete	200.00	Meter man
Kerens	2,000	Complete	225.00	Part time
Teague	3,500	Anopheles	110.00	Part time
Blooming Grove	1,100	Complete	130.00	City marshal
Frost	1,100	Complete	100.00	City marshal
Hillsboro	7,000	Complete	600.00	Full time
Midlothian	1,300	Partial	50.00	Part time
Alvarado	1,400	Complete	75.00	Part time
Alvarado	1,800	Partial		Boy Scouts
Corsicana	20,000	Partial	225.00	Part time
Smithville	3,500	Partial	60.00	City health of.
Taylor	6,500	Partial	625.00	Part time
Georgetown	3,000	Complete	65.00	City health of.
Brenham	5,500	Complete	625.00	Full time
Elgin	1,700	Partial	115.00	Meter man
Bartlett	2,000	Complete	250.00	City health of.
Cameron	5,000	Partial	150.00	Part time
Bryan	7,000	Complete	620.00	
College Station	3,000	Complete	650.00	Full time
Navasota	5,000	Complete	375.00	Full time
Seguin	3,700	Complete	900.00	Full time
Lockhart	4,000	Complete	270.00	Part time
Somerville	1,500	Complete	325.00	Part time
Hearne	3,000	Complete	850.00	Full time
Calvert	2,500	Complete	225.00	City marshal
Rockdale	2,500	Complete	130.00	Part time
Groveton	1,200	Complete	440.00	City marshal
Austin	40,000	Anopheles	1000.00	B. S.-meter
Manor	1,000	Complete	100.00	Part time
Luling	4,000	Complete	840.00	Full time
Eastland	10,000	Complete	1300.00	Full time
Clarkesville	4,000	Complete	2000.00	Full time
Sherman	17,000	Anopheles	1125.00	Full time
Honey Grove	3,000	Complete	300.00	C. h. o. m'rsh'l
Paris	17,000	Anopheles	300.00	City engineer
Greenville	14,000	Complete	500.00	Full time
Farmersville	2,500	Complete	250.00	City health of.
Whiteright	1,000	Complete	300.00	Mayor
McKinney	7,000	Complete	500.00	City health of.
Plano	1,600	Complete	200.00	Mayor, Scouts
Frisco	900	Complete	500.00	City health of.
Celina	1,200	Complete	50.00	Part time
Alvord	1,400	2 months	100.00	City marshal
Mt. Pleasant	4,500	Anopheles	300.00	Part time
Nacogdoches	4,000	Complete	1555.00	Full time
Jacksonville	5,000	Complete	635.00	Full time
Lufkin	7,000	Partial	1405.00	Full time
Crockett	4,000	Complete	670.00	City marshal
Trinity	1,500	Complete	400.00	City marshal
Livingston	1,200	Complete	325.00	Part time
Grapeland	1,200	Anopheles	33.00	City health of.
Alto	1,200	Complete	390.00	City marshal
Henderson	2,500	Complete	342.00	Full time
Longview	5,000	Partial	225.00	Part time
Tyler	15,000	Partial	119.00	Full time
Marshall	18,000	Complete	1760.00	Full time
Center	1,200	Partial	80.00	Part time
San Antonio	165,000	Complete	8800.00	Full time
Houston	140,000	Anopheles	5000.00	Full time
Total 70 cities	898,200		$54,951.00	

Note—Complete control denotes control of all species of mosquitoes.

Anopheles control denotes control of anopheles only. Partial control denotes complete of anopheles and partial control of other species.

1923 reports of 14,759 cases were received. The same period of 1924 resulted in only 12,755 cases, but the latter year represents a larger number of reports.

Owing to its proximity to Mexico, it has been deemed necessary by the United States Public Health Service to insure safety from a yellow fever epidemic by establishing a control belt against the aedes aegypti mosquito along the border. This has been a work of no small magnitude. More than 50 cities and villages have established mosquito control under the supervision of the Public Health Service. Undoubtedly this work reduces malaria also, though the territory covered does not lie in the most malarial section of the state.

No malaria control on a county wide basis was attempted in 1924 except such activities as were incidental to the regular functions of county health units. In eight counties campaigns of education were carried on in cooperation with the part-time county health officers and school superintendents, for the purpose of arousing public sentiment for malaria control and perhaps will lead to the adoption of anti-malaria measures in the future by county commissioners. This work has been in the nature of an experiment and no conclusions can be drawn as yet. Incidentally, close to 100,000 pieces of mosquito literature were distributed in towns and counties. A new mosquito film was purchased and many lectures were given.

MALARIA CONTROL ACTIVITIES IN VIRGINIA*

By L. L. WILLIAMS, JR., M.D.,
State Board of Health,
Richmond, Va.

(1) *School History Index.*—School history index to measure malaria was taken in 1922 and 1923 and is now being taken for 1924. The cards are carried to the teachers who distribute them to the school children, the cards being filled in at home by the parents. The reporting of malaria by local physicians and the discovery of foci by county health officers has checked so favorably with the school history index as to cause the malaria department to make this an annual activity.

(2) *Anopheles Observations.*—Anopheles observations were made in nine counties by full-time health officers and sanitary officers. In the early seasons crucians were found to predominate with punctipennis close second and quadrimaculatus few. In the middle of the season quadrimaculatus predominated, and the latter part of the season the crucians and punctipennis predominated as in the early part of the season. In the counties with a low malaria incidence crucians and punctipennis predominated throughout the season. In counties with high malaria incidence, quadrimaculatus predominated in malaria season. In two counties where there was very little malaria, but with heavy breeding, hatchings showed nearly all to be crucians, with a few quadrimaculatus at the height of the malaria season. In

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another county at the height of the season when malaria was very heavy, nearly all of the hatchings showed quadrimaculatus, with only a very few crucians. Apparently, in Virginia quadrimaculatus and crucians do not like to breed in the same places. The counties with the heaviest quadrimaculatus breeding show 7.5 per cent malaria incidence, whereas the counties showing the heaviest crucians breeding showed only 1.4 per cent malaria incidence. From breeding areas punctipennis and crucians were hatched from time to time in all types of water, that is, from ponds, swamps, streams, and seepage areas. On the other hand, other than the few exceptions, quadrimaculatus breeding was entirely confined to the ponds and lakes. These exceptions were pot holes in dry stream beds. Of a total of 581 adult mosquitoes caught inside of houses, 550 were quadrimaculatus, 30 crucians, and 1 punctipennis. The 30 crucians caught inside houses were in a county where crucians breed almost exclusively.

(3) *Relation of Ponds to Anopheles and Malaria.*—As a result of the school history index, the physicians' reports, and surveys made by the malaria department and county health officers, it was found that a very large percentage of malaria in Virginia was located around impounded water areas. For this reason a study was made of sixteen projects, including mill ponds, fish ponds, and impounded areas for town and city water supplies.

Four ponds without any anopheles breeding were studied, and three ponds which had anopheles breeding, but no quadrimaculatus.

One pond which had had fluctuation control for years was studied.

Control last fall and the first part of the present season was studied for one pond.

Fluctuation control during all of this season was studied for three ponds.

Four ponds producing quadrimaculatus during the entire season (no control) were studied.

About the ponds which produced no anopheles there was no malaria in spite of the fact that nearby ditches and streams did produce anopheles other than quadrimaculatus. In ponds breeding crucians and punctipennis, but no quadrimaculatus, no malaria was found within flight range. In ponds under fluctuation control for several years anopheles breeding was found to be so sparse as to be negligible. The people in the homes surveyed in these neighborhoods stated that they had not had malaria for many years.

Near the ponds placed under control the latter part of the preceding season and the early part of this season which were heavy breeders, and a survey of the homes showed that they had had a great deal of malaria. After the ponds were put under control few new cases developed. In one of these ponds where control measures were stopped during the height of the season, quadrimaculatus breeding commenced and became very heavy. Later, new cases of malaria began to be reported.

Around ponds in which no control measures were carried out and where quadrimaculatus were breeding heavily throughout the season, new cases of malaria continued to develop. Incomplete as this investigation is, it does give concrete evidence bearing on the question of the specific convection of malaria and also very good evidence on the selective breeding of quadrimaculatus. It gives rather reasonable grounds for the conclusion that in Virginia:

(1) Quadrimaculatus are the main malaria vectors.

(2) Quadrimaculatus are pond breeders.

(3) Control of ponds will control malaria.

(4) *Special Studies.*—This work included a few ponds in the state in which breeding has never been found, although breeding was found in marshy areas and streams very close to these ponds. One of these ponds in particular, had never had any anopheles breeding but was similar in every respect to a pond a mile and a half away which bred profusely before being drained. Another year's study will be given to these ponds before any opinion will be given as to why these ponds will not breed. Studies were also made in screening as to the feasibility of excluding anopheles from poorly constructed shacks. Special studies were also made of preferential roosting places of anopheles.

(5) *Education of County Health Officers.*—In a county-wide malaria control program it is necessary that there be an interested and informed organization of one or more persons resident within the county. The difficulties of interesting and educating the county health officers have heretofore appeared to be greater than one would naturally expect.

This season a new scheme was put into effect, one purpose of which was to increase the health officer's interest and information. Under this method each man was given certain designated breeding and roosting areas at which he was required to make weekly visits collecting and hatching larvae and collecting adults. This has produced a distinctly good reaction. In the first place, greater interest has been aroused and in the second place errors of knowledge and observation have been corrected. Among the mass of work to be done by a county health department this scheme has had the effect of keeping malaria before the health officer's mind.

MALARIA CONTROL ACTIVITIES IN CALIFORNIA*

By LOUVA G. LENERT, C.E.,
State Board of Health,
Sacramento, Calif.

I shall make my remarks as brief as our appropriation.

California has no direct appropriation for malaria

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control. It has employed its malaria personnel, which you see before you, from an appropriation for other purposes.

We have in California a number of county health units, but none of them is located in a district which is supposed to be malarious, and consequently we have no county health program which includes malaria work. Practically all malaria control work in California is done under an organized mosquito abatement district plan, and is conducted on a basis of controlling all mosquito breeding. There are now seventeen districts in the state and others are being added gradually until it is hoped all of the foci of malaria in the Sacramento and San Joachim Valleys will be included. This is about all that our plans for the future consist of.

Not a great deal of enthusiasm can be created in California by advocating mosquito control for the control of malaria. Much more can be accomplished by using malaria control as a side issue of the benefits to be derived from the control of all mosquitoes. After a mosquito abatement district is once established, the income and the authority for conducting the work is permanently provided for and there need be no further campaigns for funds.

Our districts vary in size, the smallest being three square miles and the largest something like one hundred and sixty square miles in area.

Of course conditions in California are quite different from those in the South. It would be difficult to carry out complete mosquito elimination in an area of 160 square miles, here, with a reasonable expenditure of funds. This is done, however, in one of the largest districts south of San Francisco. Most of the districts in the malarious sections of the state are small, ranging in size from three to sixty square miles, and no distinction is made between varieties of mosquitoes so long as they are known to attack human beings. All mosquitoes are controlled and, I think, so far as the success of malaria control goes, in California, it will have to be continued on this basis. Malaria is fast approaching a minimum in California, and many physicians even in the great valleys, do not see more than one or two cases throughout an entire year.

MALARIA AND MOSQUITO CONTROL IN ILLINOIS*

By I. D. RAWLINGS, M.D.,
Director Illinois State Department of Public Health,
Springfield, Ill.

The somewhat popular belief that malaria is no longer a problem in Illinois is unfounded. True, the drainage of land for agricultural purposes, the gradual improvement in living conditions, the greater interest in public health problems, and other improvements, have greatly reduced malaria, but the disease still remains of considerable importance.

In 1916, the Illinois Department of Health published in Health News an article calling attention to the widespread prevalence of malaria in southern Illinois. In 1917 at a meeting of the Southern Illinois Medical Society a resolution was passed requesting that a survey be made by the state to determine the extent and distribution of malaria and malaria-bearing mosquitoes in southern Illinois. During 1918, 1919, and 1920 investigations were carried on by the State Natural History Survey in several Illinois cities, including Carbondale, Herrin and Belleville.

DISTRIBUTION OF MALARIA AND MOSQUITOES

Mosquitoes are quite widely distributed over the entire state. In fact, in some of the territory adjacent to Chicago the mosquito nuisance is perhaps more severe than in the southern portions of the state. Malaria and malarial mosquitoes, however, are confined principally to the southern portion, although the Anopheles mosquito has been found and deaths from malaria have occurred in counties as far north as Cook. The twelve most southern counties containing approximately 5 per cent of the population of the state, have approximately 60 per cent of the total malaria of the state.

SPECIES REGIONAL IN ILLINOIS

Prior to any control work, studies were made of mosquito species at Carbondale and Herrin by the State Natural History Survey. The species frequently found during the investigations and reported by the survey are as follows:

(1) Anopheles guttulatus: Harris (Say).
(2) Anopheles punctipennis (Say).
(3) Anopheles crucians: Wied.
(4) Culiseta inornata (Williston Dyar).
(5) Culex apicalis: Adams (saxatilis gross).
(6) Culex territaus: Walker (restuans Theob.).
(7) Culex pipiens: Linn.
(8) Culex salinarins: Coquillet.
(9) Culex degustator: Dyar.
(10) Aedes canadensis (Theob.) D. & K.
(11) Aedes sollicitans (Walker) D. & K.
(12) Aedes sylvestris (Theob.) D. & K.
(13) Aedes sp. (near taeniorhynchus, Wiedemann, Busck).
(14) Uranotaenia sapphirina (O. S.) Lynch Arribalzaga.
(15) Psorophora ciliata (Fabricus) Robineau-Desvoidy.
(16) Psorophora sayi (D. & K.).

Of the Anopheles species, the punctipennis is notably the predominating species although quadrimaculatus and crucians are frequently noted. Aedes aegypti, although not suspected as being regional in Illinois, were found in considerable numbers at Carbondale after completion of the State Natural History Survey investigations.

STATUS OF MALARIA CONTROL IN ILLINOIS

Malaria control in Illinois has not yet passed beyond the demonstrative stage. The work is being supervised entirely by the Division of Sanitary Engineering and the results thus far obtained have been secured solely through the eradication of mosquitoes. No attempt has

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been made in any of the cities where malaria control projects have developed, to control malaria through distribution of quinin, advocation of the standard treatment or any other measures that might properly be the function of a medical health officer.

The work has not yet developed on a county-wide scale for the reason that none of the counties in which work has been done have regular county health organizations. And none of the counties where malaria constitutes a rather serious problem are likely to develop a county health unit solely for the purpose of engaging in county-wide malaria control. It appears that county-wide malaria control in Illinois is dependent entirely upon regular county health organizations established primarily for the control of communicable diseases in general, the problem of county-wide malaria control becoming a part of the work embraced by such an organization.

Malaria control in Illinois, although a comparatively new venture, has enjoyed a steady growth since its inception. In 1922 a community control campaign was conducted at Carbondale; in 1923 campaigns were conducted at Carbondale and Belleville; in 1924 campaigns were conducted at Carbondale, Belleville and Herrin; and in 1925 it is probable campaigns will be conducted in two or three additional cities.

CARBONDALE PROJECT—1922

Carbondale, a city with a population of 6,267, is located in Jackson County 56 miles north of the junction of the Ohio and Mississippi Rivers. In 1922 the Lions Club of that city, with financial assistance from the International Health Board and the Illinois Central Railroad Company, undertook an anti-malaria and mosquito campaign. Other organizations aside from the State Department of Public Health which cooperated in the work, were the United States Public Health Service, State Natural History Survey, and the City of Carbondale.

Physicians' estimates during the previous years showed the malaria morbidity rate of the city to be about 300 cases, or 4.7 per cent per year. In 1922 a house-to-house canvass revealed 189 cases for 1920 and 267 cases for 1921.

About 60 acres of cat-tail swamps were drained by dynamited ditches. In the course of the campaign 4.45 miles of ditches were cleaned, regraded and maintained, 140 miles of ditches and lake edges oiled, 12 small ponds drained, 584 open wells and cisterns and remaining lakes and ponds stocked with Gambusia, and 8 house-to-house inspections made. The total cost of the work exclusive of state supervision was $2,798.53, or about $0.44 per capita.

The results of the work were extremely gratifying. In addition to securing almost complete relief from the mosquito nuisance, a substantial reduction in malaria cases was made. Physicians estimated at the end of the season that there had been 54 cases chargeable to Carbondale as compared with 300 during preceding years. From a house-to-house canvass only 19 cases were revealed for the season compared with 267 and 189 cases determined by house-to-house canvasses for the two preceding years.

The total economic saving effected over 1921 was estimated to be $18,500.00.

CARBONDALE PROJECT—1923

In 1923 the work was continued under state supervision without outside financial assistance. During the season 176 miles of ditches and lake edges were oiled, 3 house-to-house inspections made and the swamp drainage completed. The total cost of the work exclusive of state supervision, was $1,437.55, or about $0.23 per capita.

At the end of the season physicians estimated that there had been 22 cases chargeable to Carbondale. From a house-to-house canvass only 11 cases were revealed.

The total economic saving effected over 1921 was estimated to be $24,000.00.

CARBONDALE PROJECT—1924

During the past season the work was again continued. Owing to the financial condition of the city, the local Lions Club was forced to bear the entire expense of the campaign. The oiling work was continued until September 1 when the anti-mosquito fund became depleted. The total cost of the work was $477.12, or $0.076 per capita.

Local physicians have estimated that there have been 44 cases chargeable to Carbondale. With one more physician to be heard from, it is likely that the 1924 cases will exceed 50.

The total economic saving effected over 1921 is estimated to be approximately $21,000.00.

BELLEVILLE PROJECT—1923

So successful was the work at Carbondale that Belleville, a city with 24,741 population, located 17 miles southeast of St. Louis, in St. Clair County, undertook an anti-malaria and mosquito campaign. Financial assistance was secured for the first year's work from the International Health Board.

While malaria in Belleville is not considered to be a serious problem and the mosquito nuisance was responsible for the control work, statistics indicated that the city suffered approximately 1 per cent malaria morbidity rate. From a house-to-house canvass of 1608 residences representing a 6853 population, 49 cases were revealed for 1922.

During the summer 286 miles of ditches and lake edges were oiled, 7 acres of marsh land drained and one complete house-to-house inspection made.

The total cost of the work was $3020.56, or $0.12 per capita.

At the end of the season a canvass of the 1608 residences which were canvassed in the spring was made and 6 cases of malaria revealed, indicating a substantial reduction.

The total economic saving effected over 1922 was estimated to be $8,600.00.

BELLEVILLE PROJECT—1924

During the past season the control work was conducted by the city without outside financial assistance. The oiling work was continued and house-to-house inspections were made. The total cost of the work was $1710.96, or $0.07 per capita. No estimates of malaria cases for this year have been prepared, but from the standpoint of eliminating the mosquito nuisance the work was entirely successful and provisions are being made for continuing the work during 1925.

HERRIN PROJECT—1924

Herrin, with a population of 10,986, is located in Williamson County, 13 miles east of Carbondale. Control work was started this year by the city and local civic organizations, assisted financially by the International Health Board.

In 1920, physicians estimated that there had been 247 cases of malaria in the city. During this year a house-to-house canvass revealed 234 cases for 1923.

Because there were some marshes adjacent to the city created by the coal mine water supply reservoirs which could not be drained, complete control could not be secured. During the course of the campaign several small ponds and marshes were drained, 2 miles of ditches cleared and regraded, approximately 140 miles of ditches and lake edges were oiled, other marshes were treated with Paris green and two complete house-to-house inspections were made.

The total cost of the work was $2483.00, or $0.225 per capita.

From a house-to-house canvass made in October, 66 cases were revealed, indicating a substantial reduction in malaria.

The total economic saving effected over 1923 is estimated to be $14,300.00.

DESPLAINES RIVER PROJECT—1922

The most notable project conducted in the state and not directly under state supervision, was the Chicago Sanitary District project along the Desplaines River in 1922. Purely a project divorced from malarial consideration, 72 square miles were placed under control at a cost of approximately $1250 per square mile. In 1923, although the work had been very successful, no provision was made for the work in the Sanitary District's appropriations, but the work was carried on to some extent individually by some of the cities and communities which had received benefits the previous year.

THE FUTURE OF MALARIA AND MOSQUITO CONTROL IN ILLINOIS

The work thus far carried on in Illinois has proved successful, as is evidenced by the facts that it has enjoyed a steady growth and that no city where work has been started has allowed it to lapse in the succeeding years. The work furnishes a good foundation for further extensions.

Future plans include the earliest possible development of the county health unit so that malaria control may be conducted on a county-wide scale in the counties where malaria constitutes a serious problem, and the extension of the malaria-control demonstrations to other cities.

Last year in the heavily populated districts adjacent to Chicago, mosquitoes became so troublesome that a great deal of interest over the subject of mosquito control was developed. Indications are that legislation affecting the work and providing for the legal establishment of mosquito-control districts similar to drainage and sanitary districts, will shortly be enacted. In the event of such favorable legislation, it is apparent that malaria and mosquito-control work will have received a great stimulus in Illinois.

In connection with the probable development of anti-mosquito projects in northern Illinois, the Department of Health has conducted some experiments with Gambusia in Cook County. It has been the impression for some time that Gambusia could not survive the long cold winters of northern Illinois. While this fact is not yet proved or disproved, it is a fact that Gambusia placed in several ponds in Cook County in the fall of 1923 are present in noticeable numbers in the fall of 1924. If it develops that Gambusia are able to survive and reproduce in northern Illinois, it is likely that the minnow will play an important role in the control projects which are to develop in that section.

From present information, it is likely that Carbondale, Belleville and Herrin will continue the control work during 1925. The city of Pekin has indicated that it will also undertake control work. With these projects in view and the possibility that one or two additional cities may be encouraged to carry on the work, prospects for 1925 control work are good. While the work has not developed as rapidly as perhaps it would were Illinois confronted with the same malaria problem as the South, there is encouragement in knowing that the work has met with favorable public response, has been successful in all of the projects undertaken and has contributed to the contention that it is a growing field of endeavor.

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C. P. LORANZ, Secretary-Manager

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EDITORIAL DEPARTMENT

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QUININ THERAPY IN MALARIA

A recent review of the treatment of malaria by Lt. Col. Clayton Lane* contains much valuable information and also some startling statements as to what we actually know concerning the way in which quinin acts upon malaria plasmodia in the human host. According to Col. Lane, we know very little of the way in which quinin exercises its beneficent effect in the cure of malaria. We do know that however administered quinin promptly enters the blood and as promptly disappears from it. Within three minutes after injecting quinin directly into the rabbit's circulation 90 per cent of it disappears from the blood stream to be either excreted unchanged or stored in the internal organs and destroyed. In whatever way it is administered, from 15 to 35 per cent more or less of the quinin is excreted unchanged in the urine. The remainder after being stored in the tissues, is metabolized and disappears leaving no trace. It is not known whether the therapeutic value of quinin is attributable to that part which remains unchanged and is excreted as such or results from the metabolized quinin. The evidence suggests that in either event quinin is never sufficiently concentrated, either in the blood stream or in the tissues, to act as a specific poison to the plasmodia, but that it acts either directly or indirectly by producing bodies which are poisonous to them.

Much labor has been spent by investigators in the attempt to determine the best method or methods of administering quinin, and certain facts have been established or at least strongly suggested. Apparently there is no evidence to indicate that there is such a phenomenon as quinin resistance. But it does appear that the season of the year in which quinin is administered has a considerable effect on the percentage of relapses. In a series of several hundred cases of malaria given the same quinin treatment and kept under close observation in Liverpool, England, the percentage of relapses for the four quarters of the year were 96.7, 78.3, 36.5 and 64.8. Clearly, the percentage of cures was much higher during the late summer months.

Observers are in general agreement that recent infections are essentially curable, while chronic cases and repeated infections are less easily cured. Any practitioner in the South knows as much, and this emphasizes the importance of the prompt and adequate treatment of malaria infections. As to the best route and time of administering quinin, there is no evidence that disinfection is more readily obtained with intravenous than with orally administered quinin; but where rapid access of quinin to the blood stream is imperative, as in coma, or in the case of imperfect absorption from the intestinal tract, intravenous medication is strongly advocated. The danger from wide spread necrosis following the intramuscular injection of quinin is uncertain, and this uncertainty and the attendant pain renders it doubtful that this method of administration should ever be employed. So far as scientific observations show, there is no good reason for giving quinin at any special phase in the life cycle of the malaria plasmodia, nor is there any evidence in favor of the belief that provocatives which cause reappearance of plasmodia in the cutaneous circulation aid the action of quinin in any way. Apparently quinin is more

*Lane, Clayton: Trop. Dis. Bull., Nov., 1924.

potent against schizonts of Plasmodium falciparum than of Plasmodium vivax, whereas for the gametocytes the condition is reversed.

The present knowledge forms no scientific basis for determining the best line of treatment with this valuable drug, and, indeed, gives no indication as to whether such special modifications of administration as have been strongly advocated really serve any useful purpose. Despite its imperfections quinin remains invaluable and unsurpassed in the treatment of the malarias.

THE EXTRA-DIABETIC USE OF INSULIN

Banting, in known cases of diabetes, uses insulin only where all dietary measures have failed to maintain the patient. If the drug had ever been allowed to fall into unscrupulous hands, its advertisers would certainly have advised diabetics to eat all they wished and to use large quantities of insulin; and thus insulin might have fallen into considerable disrepute. It behooves the medical profession to be as conservative as the discoverer of insulin, in recommending its employment in non-diabetic cases. A widening field of usefulness must depend upon further elucidation of the underlying mechanism by which insulin causes sugar to disappear from the blood stream.

According to MacLeod[1] and others, the disappearance of sugar after insulin injection is not due to glycolysis. The sugar is not destroyed in the blood, nor is it excreted by the kidneys. MacLeod assumes that in the presence of insulin sugar is consumed very rapidly by the tissues, chiefly by the muscles, and thus a sugar vacuum is created in the tissues, into which sugar from the blood rapidly pours.

Phosphorus and the phosphates are intimately concerned with carbohydrate metabolism. When lactic acid is formed in the muscles, as it is whenever muscular contraction takes place,[2] phosphoric acid is formed in equimolecular proportions.[1] If glucose is injected with or without insulin, the blood phosphates are decreased. After having given insulin to dogs, Eadie, MacLeod, and Noble[3] noticed that a rapid fall in the blood phosphates occurred which ran almost parallel with the drop in glucose. The phosphorus was low for four to six hours after the injection of insulin, then rose fairly rapidly, its rise preceding the rise in blood sugar. Coincident with the fall in blood phosphorus, the urinary phosphorus completely disappeared for six to eight hours, after which it reappeared in larger than normal amounts. The twenty-four hour excretion of phosphorus was augmented from twenty-five to thirty-five per cent. Similar results were obtained with four out of six experimental rabbits. The authors attempted to discover the effect of glucose and insulin upon tissue phosphates, and conclude that insulin has no effect upon the distribution of phosphorus in the tissues.

The fact that phosphorus is largely consumed in the utilization of glucose is worthy of considerable attention. Phosphorus is intimately concerned in the maintenance of the normal alkalinity of the blood as well. An adequate supply of this mineral in normal diets to take care of normal carbohydrate consumption should be emphasized. The value of certain minerals in the diet of infants and adults has long been recognized. The mineral element has never received the publicity of the vitamins before the laity, but it is perhaps equally important. The injection into experimental animals of buffered phosphate solution with the therapeutic dose of glucose might throw light upon glucose and phosphorus utilization. If further work shows that the decrease in blood phosphorus and subsequent increase in excretion of phosphorus are found regularly in human beings after insulin and glucose, a practical application is suggested. A glucose-phosphate solution might pos-

1. MacLeod, J. J. R., and Banting, F. G.: The Anti-diabetic Functions of the Pancreas and the Successful Isolation of the Anti-diabetic Hormone. C. V. Mosby Co., St. Louis, 1924.
2. Howell, W. H.: A Text-book of Physiology. Ninth Edition, Philadelphia and London: W. B. Saunders Co., 1925.
3. Eadie, G. S., MacLeod, J. J. R., and Noble, E. C.: Further Experiments on the Action of Insulin. Am. Jour. Physiol., 72, 3, May 1, 1925.

sibly offer an improvement in technic over glucose alone with insulin.

Insulin injections with glucose in the treatment of athreptic infants have been favorably reported upon by R. L. Pitfield[4] and also McKim Marriott.[5] Insulin and glucose have been used considerably recently in the treatment of postoperative vomiting and acidosis.[6 7] They have also been favorably reported in combating the toxemic vomiting of pregnancy[8] and in cyclic vomiting of childhood.[9]

Since every known general anesthetic inevitably produces hyperglycemia,[1] it is conceivable that injections of glucose and insulin may become in the future a routine postoperative treatment of cases in which difficult reaction to anesthesia is anticipated.

On the other hand, the hyperglycemia of anesthesia may be protective, may be merely an indication that the relaxed anesthetized muscle can not use sugar so fast as it is being released into the blood stream. In the latter case, injection of insulin and consequent forcing of glucose into the tissues may be treating a symptom, and may be physiologically contra-indicated. It is necessary to take all these factors into account before administering a very powerful drug.

THE GORGAS MEMORIAL INSTITUTE

The United States has facilities for becoming the most healthful country in the world. However, it is now credited with having twenty-five million cases of illness every year in a population of one hundred and ten million. Understanding of the possibilities of preventive medicine is growing apace among physicians. A great influence in the dissemination of some of this knowledge among the profession and laity will be the Gorgas Memorial Institute of Tropical and Preventive Medicine.

It is fitting that the most picturesque and dramatic conquest of disease in medical history, that over yellow fever in the Panama Canal Zone by General Gorgas, should be the inspiration for a great institute of preventive medicine. News of its progress is always gladly read.

The American Dental Association has now joined the physicians in support of the ideal of preventive medicine, and has appointed a Chairman of the Gorgas Memorial Committee, Dr. D. M. Gallie, of Chicago, to cooperate in the work of the Institute. This assistance will not only be invaluable in the work, but is valuable as a sign of the growing momentum of the movement to lower morbidity through the enlightenment of the civilized world. The Institute, in honor of the Southerner, General Gorgas, will always be proudly helped by Southern physicians.

4. Pitfield, R. L.: Insulin in Infantile Inanition. N. Y. Med. J., 118, 251, Aug. 15, 1923.
5. Marriott, McKim: Jour. Am. Med. Assn., 83, 600, Aug. 23, 1924.
6. Thalhimer, William: Insulin Treatment of Postoperative Non-Diabetic Acidosis, Jour. Am. Med. Assn., 81, 696-699, Aug. 4, 1923.
7. Fisher, David, and Snell, Myron: Treatment of Shock with Glucose Infusions and Insulin. *Ibid*, 83, 1907-8, Dec. 13, 1924.
8. Thalhimer, William: Insulin Treatment of the Toxemic Vomiting of Pregnancy. *Ibid*, 82, 696-699, Mar. 1, 1924.
9. Greer, David: Observations on the Treatment of Acute Cyclic Vomiting of Childhood with Glucose Solution and Insulin. Sou. Med. Jour., this issue, p. 395.

Book Reviews

Anatomy of the Human Body. By Henry Gray, F. R. S., Fellow of the Royal College of Surgeons; Lecturer on Anatomy at St. George's Hospital Medical School, London. Twenty-first Edition. With 1417 pages and 1283 Engravings. Thoroughly Revised and Re-edited by Warren H. Lewis, B. S., M. D., Professor of Physiological Anatomy, Johns Hopkins University, Baltimore, Md., Research Associate, Carnegie Institution of Washington. Philadelphia and New York: Lea & Febiger, 1924.

The twenty separate revisions since its original publication in 1858 have offered unparalleled opportunity for perfecting a well planned volume. The work deals successively with embryology, osteology, syndesmology, myology, angiology, the arteries, veins, lymphatic system, neurology, sense organs and integument, splanchnology, and surface anatomy.

For wealth and accuracy of descriptive detail, Gray's is probably unequalled. The newer work on capillary anatomy is not included, though perhaps this would be out of place in a general text-book, and the islands of Langerhans are not described among the glands of internal secretion. There are possibly other omissions which can not be avoided in a book of this size. It is a remarkable compilation which will long hold its place as one of the corner stones upon which the medical student must build.

Laboratory Diagnostic Methods, Pathological, Bacteriological, Serological and Chemical. A Manual for Physicians, Medical Students and Laboratory Technicians. By John A. Kolmer, Professor of Pathology and Bacteriology in the Graduate School of Medicine of the University of Pennsylvania and Pathologist to the Medico-Chirurgical and Polyclinic Hospitals; and Fred Boerner, Associate in Bacteriology in the Graduate School of Medicine of the University of Pennsylvania. 338 pages. New York and London: D. Appleton and Company, 1925.

Several very good textbooks of the methods of procedure in common use in the hospital laboratory have recently appeared. This by Kolmer and Boerner is probably the best short work available. It gives well selected methods of analysis of the blood, urine, gastric contents, bile and duodenal fluids, feces, sputum, and cerebrospinal fluid. The sections on clinical, bacteriological and serological methods, and blood chemistry methods are complete, clear and compact.

The one serious drawback of the work is the absence of illustrations which should accompany any work dealing with clinical microscopy. The authors state, however, that these have been purposely omitted.

Leprosy. By Sir Leonard Rogers, C. I. E., M. D., F. R. C. P., F. R. C. S., F. R. S., I. M. S. (Retired), Physician and Lecturer, London School of Tropical Medicine; late Professor of Pathology, Calcutta Medical College, and Ernest Muir, M. D., F. R. C. S., Edin., Research Worker in Leprosy at the School of Tropical Medicine and Hygiene, Calcutta. 301 pages, illustrated. New York: Wm. Wood and Company. Cloth, $4.75.

The international acceptance of the authors as authorities on leprosy makes the book one to which one turns with a feeling of expectancy. The subject is very carefully presented, due proportion being assigned to its different phases. There are no parts that can not be classed as up to a high standard. It is a valuable contribution and one that will long be accepted as a standard. The practical application of diagnostic and therapeutic methods is always kept before the reader.

Human Constitution. A Consideration of Its Relationship to Disease. By George Draper, M.D., Associate in Medicine at Columbia University, New York City. Octavo of 345 pages with 208 illustrations and 105 table. Philadelphia and London: W. B. Saunders Company, 1924. Cloth, $7.50 net.

This is an attempt to show the correlation of the physiological contours, anthropometry, with certain tendencies to disease. It has often been noted that the Jews are more subject to certain constitutional diseases, such as nephritis, diabetes, amaurotic mongolian idiocy, than Gentiles; that the Negro is subject to a certain anemia which apparently does not affect the white races, and other racial differences have been marked by various observers. Draper has over a hundred tables of bone measurements of persons with morbid conditions. The tables may be of some slight value in diagnosis. At any rate, it is well worth while to consider familial disease tendencies from the anthropometric angle; as Draper says, "to pay attention to the individual under consideration rather than the disease, perhaps to equalize the distribution of the investigative effort upon the three basic elements of the disease problem: man, the lesion, and the environmental stress."

The Life of Sir William Osler. By Harvey Cushing. Volumes I and II. New York: Oxford University Press, 1925.

What could be more appropriate than that the biography of the physician who exerted the greatest influence upon the teaching of American medicine in his generation, should be written by his friend and former associate, whom many consider America's greatest living surgeon?

Cushing was intimately thrown with Osler from a time when the Hopkins Hospital staff comprised a mere handful of enthusiastic, brilliant young workers, intermittently till Sir William's death.

The two volumes are divided into three sections: I, the Canadian Period; II, the United States Period; and III, the Oxford Period.

Himself a writer of rare attainments, Dr. Cushing has produced a charming biography by using innumerable extracts from Osler's letters and essays. These are correlated and interpreted with ample notes by Cushing. It is not a mere chronicle of events, but a series of insights into the daily life of the man.

No man ever came within the circle of Osler's influence without being drawn to him. His wisdom and his wit afforded a never failing source of reminiscences for his friends and associates. "As Dr. Osler would say," is an introduction familiar to many who never had the privilege of coming under his spell, but who have often heard his sage remarks via "Apostolic succession," so to speak.

Cushing's "Life of Sir William Osler" will rank high among American biographies in general and not merely among those medical.

Pye's Surgical Handicraft: A Manual of Surgical Manipulations, Minor Surgery, and Other Matters Connected With the Work of House Surgeons and Surgical Dressers. Edited and largely rewritten by W. H. Clayton-Greene, C.B.E., B.A., M.B., B.C. (Camb.), F.R.C.S. (Eng.), Surgeon to St. Mary's Hospital; Lecturer on Surgery in the Medical Schools, etc. Ninth Edition, fully revised, with some additional matter and illustrations. New York: Wm. Wood and Company. Cloth, $7.00.

The mere fact that this book is appearing in its ninth edition does not lessen its right to be praised.

Written especially for house surgeons, it goes straight to the subject and discusses the mechanics of surgical dressings and appliances without offering any apology for not being a complete work on surgery. It is full of helpful suggestions, not alone for the neophyte, but for anyone engaged in surgery.

A Manual of Obstetrics. By John Cooke Hirst, M.D., Associate in Gynecology and Obstetrics Graduate School of Medicine, University of Pennsylvania; Associate in Obstetrics, School of Medicine, University of Pennsylvania. Second Edition, Entirely Reset. 12 mo of 551 pages with 229 illustrations. Philadelphia and London: W. B. Saunders Company, 1924. Cloth, $4.50 net.

The only criticism to be made of this, which is a serious one, however, is that it contains not a footnote or bibliographical reference. This is certainly a bad example to put before the student. From other points of view, it is an extremely good resume, by one who has had a long experience in obstetrical teaching.

Clinical Features of Heart Disease. An Interpretation of the Mechanics of Diagnosis for Practitioners. By LeRoy Crummer, M.D., Professor of Medicine, University of Nebraska. New York: Paul B. Hoeber, Inc. Cloth, $3.50 net.

This volume is written from experience gained while the author was in military service, and the subject is considered from the British point of view of cardiology.

The sections devoted to history and physical examination with the exception of percussion, are practical and well expressed; but there is too radical a stand on the small value of percussion in cardiac diagnosis. The section on Mechanical Aids is too dogmatic, and these are not properly presented so that their uses and limitations may be understood. The discussion of cardiac irregularities lacks the clearness that occurs in other sections of the book.

The consideration of the valvular conditions is well written and the manner in which mitral insufficiency is treated is worthy of special mention. Cardiovascular Renal Disease and Decompensation are valuable sections, both for the manner of presentation and the advice as to management. The chapter on Treatment is more elementary than other parts of the book. Cardiac Neuroses are not clearly delineated and their diagnosis and treatment are scantily touched upon.

Cardiac Emergencies is another disappointment, for the section has not been arranged for quick reference.

The Conclusion is full of sound advice and shows careful preparation. The Appendix is "Circular 21, War Department Surgeon General's Office, 1917." The instructions are those by which all men were classified on examination for the Army, and is a valuable guide and worthy of preservation.

New Views on Diabetes Mellitus. By P. J. Cammidge, M.D., (Lond.) and H. A. H. Howard, B.Sc., (Lond.) 611 pages. New York: Oxford University Press. Price $6.50.

Of the many new works on diabetes which have been published recently, this book by an English author gives us a most excellent presentation of the new views on the subject. It contains chapters on (1) normal carbohydrate metabolism, with methods of blood study, establishing normal glucose values and the effect of food, hydrochloric acid in stomach and endocrine glands on the glucose level. (2) Abnormal carbohydrate metabolism, and the effect of abnormalities in acid base equilibrium of the blood. (3) Diagnosis and classification of glycosurias, with a study of various reducing substances in the urine. (4) Principles of treatment, with especial reference to special English experimental work, and the use of Mackenzie Wallis' preparation, which has not been accepted in our country. The chief value of this book is in giving us the viewpoint of English investigators.

Proceedings of the International Conference on Health Problems in Tropical America, held at Kingston, Jamaica, B. W. I., July 22 to August 1, 1924, by invitation of the Medical Department, United Fruit Company. 1010 pages, illustrated. Boston: United Fruit Company, 1924.

The title indicates the subject matter and the occasion of the conference at Kingston, Jamaica, last summer. This volume, published by the United Fruit Company, contains all the papers read with the discussions, by authorities on practically every phase of tropical medicine. Among the authors will be found, Rosenau, Vincent, Bass, LePrince, Neusholme, Thompson, Rogers, Lane, Park, Castellani, Deeks, Noguchi, Banting and many other familiar names. The book represents the very best thought and practice on tropical diseases, and the most recent advances in surgery, medicine and hygiene pertaining to such conditions.

The United Fruit Company deserves the highest praise for sanitating many uninhabitable localities in the tropics and its chief concern is not mercenary returns, but the health and happiness of its employes.

This book is well edited, is very attractive in form, and should attract every one interested in tropical diseases.

The Blood: A Guide to Its Examination and to the Diagnosis and Treatment of Its Diseases. By G. Lovell Gulland, C.M.G., M.A., B.Sc., M.D., F.R.C.P.E., Professor of Medicine and Clinical Medicine in the University of Edinburgh; President of the Royal College of Physicians of Edinburgh, and Alexander Goodall, M.D., F.R.C.P.E., Assistant Physician to the Royal Infirmary; Lecturer on Clinical Medicine in the University of Edinburgh, and on Diseases of the Blood in the Edinburgh Post-Graduate Courses in Medicine; Physician to the Ministry of Pensions Hospital, Craigleith, Edinburgh. Third Edition. 424 pages with 29 text illustrations and 16 colored plates. New York: E. B. Treat & Company. Cloth, $7.50.

It is extremely important for Americans to acquaint themselves with the medical literature of other countries, with much of which during the World War, they lost touch. English literature shows more the effect of its proximity to the continent than does American. The fact that many Americans read foreign languages with difficulty, makes the English text book with its frequent closer relation to, and reflection of, continental literature, doubly valuable.

The first five chapters of the book of Drs. Gulland and Goodall deal with the various laboratory procedures for examination of the blood. Colored plates of the blood with different stains, and other plates are very good. There is valuable information on the development and morphology of the red and white blood cells. The complex structure of the red blood cell, omitted from many books, is described. The abnormal shapes of the red cell in anemias as relating to the organized content, glassy body, endoplasmic capsule, etc., receive a discussion which although brief is much more than is usually found in American text books.

The latter half of the book is a cataloguing and brief discussion of the diseases in which the number and kind of blood cells may or may not be affected. Chapters on the anemias, leukemias, Hodgkin's disease, etc., are to be expected. However, an enumeration of the red and white cells in the common infectious diseases, measles, scarlet fever, typhoid, leprosy, diseases of the ductless glands, skin, genito-urinary system, etc., which consumes a very large part of the book, is to say the least superfluous. Such information is dull reading and is to be found in any work describing the diagnosis of these diseases, in which one would more naturally look for it.

Chemical methods of study of the blood are given in the briefest possible space, and not satisfactorily.

Serological and cultural methods of examination are omitted. Even the technic of a Widal is not described. There is very little discussion of the methods of vital staining.

The book is misnamed. It should no more be called "The Blood: A Guide to Its Examination and to the Diagnosis and Treatment of Its Diseases," than a book upon "The Foot" should be called "Surgery." It should be called "The Circulating Blood Cells" for it deals only with these. The plasma which might have occupied a volume of equal size is entirely forgotten. If one reads it for its information upon the circulating blood cells, and skips the part dealing with blood counts in scurvy, etc., one will be very well repaid.

Operative Surgery. By J. Shelton Horsley, M.D., F.A.C.S., Attending Surgeon, St. Elizabeth's Hospital, Richmond, Va. Second Edition. 784 pages with 666 original illustrations. St. Louis: C. V. Mosby Company, 1924. Cloth, $12.50.

Horsley has dealth with many, but not all, the operations in surgery, as his preface explains. The volume includes among other subjects the gist of his splendid work on intestinal and vascular surgery, for which he is well known. The work is not complete enough for a text-book for students or for a general reference work, but it does offer a collection of monographs on many important phases of surgery, approached from a biological and physiological viewpoint. Horsley is a true student of the underlying principles of surgery, as is clearly reflected in his writings.

Applied Anatomy. The Construction of the Human Body Considered in Relation to Its Functions, Diseases and Injuries. By Gwilym G. Davis, M.D., Late Professor of Orthopedic Surgery and Associate Professor of Applied Anatomy in the University of Pennsylvania. Revised. With 656 illustrations, mostly from original dissections and many in color. Sixth Edition. Philadelphia and London: J. B. Lippincott Company. Cloth, $9.00.

This revision of Davis' well known work on applied anatomy has been made by Dr. George P. Muller. As he states: "This book has occupied a unique place in surgical literature in that it attempts to teach surgical principles through the medium of anatomical relations."

For a one volume work of less than 650 pages it covers a large field in a remarkably satisfactory way.

Books Received

Infections of the Hand. A Guide to the Surgical Treatment of Acute and Chronic Suppurative Processes in the Fingers, Hand, and Forearm. By Allen B. Kanavel, M.D., Professor of Surgery, Northwestern University Medical School; Attending Surgeon, Wesley Memorial Hospital, Chicago. Fifth Edition, thoroughly revised. Illustrated with 196 engravings. Philadelphia and New York: Lea & Febiger. Cloth, $5.50.

A Companion to Manuals of Practical Anatomy. By E. B. Jamieson, M.D., Senior Demonstrator and Lecturer of Anatomy, University of Edinburgh. Second Edition. New York: William Wood and Co. Cloth, $5.00.

Dyspepsia: Its Varieties and Treatment. By W. Soltau Fenwick, M.D., B.S. (London), Late Physician to the Evelina Hospital for Sick Children, London. Second Edition, Revised. Octavo of 515 pages, illustrated. Philadelphia and London: W. B. Saunders Company, 1925. Cloth, $6.00 net.

An Introduction to the Mind in Health and Disease. For Students and General Practitioners Interested in Mental Work. By T. Waddelow Smith, F.R.C.S. (Eng.), Deputy Medical Superintendent of the City Mental Hospital, Nottingham; Member of the Medico-Psychological Association, New York: William Wood and Company. Cloth, $4.00.

Lumbar Puncture. Its Anatomical and Physiological Relations. Technique. Methods of Investigation. Diagnostic Value and Therapeutical Applications. With an Appendix on Encephalography and Puncture of the Cisterna. By Martin Pappenheim, M.D., Professor at the University of Vienna; Medical Superintendent of the Neurological Department, Municipal Infirmary, Vienna. 248 pages. New York: William Wood and Co. Cloth, $5.00.

Diseases of Children for Nurses. Including Pediatric Nursing, Infant Feeding, Therapeutic Measures Employed in Childhood. Treatment for Emergencies, Prophylaxis and Hygiene. By Robert S. McCombs, M.D., Associate in Medicine at the Philadelphia Polyclinic; Instructor of Nurses at the Children's Hospital of Philadelphia. Fifth Edition, Thoroughly Revised. Octavo of 581 pages, illustrated. Philadelphia and London: W. B. Saunders Company, 1925. Cloth, $2.75 net.

A Practice of Gynaecology. By Henry Jellett, M. D. (Dublin University), F.R.C.P.I., Consulting Obstetrician to the Department of Public Health of New Zealand; Consulting Gynaecologist, Rotunda Hospital, Dublin; Ex-Master, Rotunda Hospital, Dublin; Formerly King's Professor of Midwifery and Gynaecology, Dublin University; Gynaecologist to Sir P. Dun's Hospital; Gynaecologist and Obstetric Physician to Dr. Steevens' Hospital, Dublin; Extern Examiner in Midwifery and Gynaecology, Dublin University, Royal University of Ireland, Victoria University, Manchester, and the University of New Zealand; Censor and Examiner in Midwifery and Gynaecology, Royal College of Physicians, Ireland. Fifth Edition. 744 pages with 417 illustrations and 15 color plates. Philadelphia: Lea & Febiger, 1925. Cloth, $8.50.

Medical and Surgical Report of The Roosevelt Hospital, New York. Second Series, 1925, Based on the Work of the Years 1915-1924 inclusive. New York: Paul B. Hoeber, Inc. Cloth, $5.00.

Personal Hygiene Applied. By Jesse Feiring Williams, M.D., Professor of Physical Education, Teachers College, Columbia University, New York City. Second Edition, revised. 12mo of 414 pages, illustrated. Philadelphia and London. W. B. Saunders Company, 1925. Cloth, $2.00 net.

Diet in Health and Disease. By Julius Friedenwald, M.D., Professor of Gastro-Enterology in the University of Maryland School of Medicine, Baltimore; and John Ruhrah, M.D., Professor of Diseases of Children in the University of Maryland, Baltimore. Sixth edition, thoroughly revised. Octavo of 987 pages. Philadelphia and London: W. B. Saunders Company, 1925. Cloth, $8.00 net.

Colds: Their Cause, Treatment and Prevention. By Russell L. Cecil, M.D., Assistant Professor of Clinical Medicine in Cornell University Medical College, New York City. 111 pages. New York and London: D. Appleton and Company. Cloth, $1.00.

The Health-Care of the Baby, A Handbook for Mothers, Nurses and Physicians. By Louis Fischer, M.D., Attending Physician to the Willard Parker and Riverside Hospitals; Chief Attending Pediatrist to the Zion Hospital of Brooklyn; Medical Director of the Infantorium; Former Instructor in Diseases of Children at the New York Post Graduate Medical School and Hospital. 15th Edition, completely revised, rewritten and reset. 267 pages. New York: Funk & Wagnalls Company. Cloth, $1.00 net.

The Medical Interpreter. A Quarterly Digest of Medicine and and Surgery, Domestic and Foreign. By Albert Allemann, A.B., M.D., Principal Assistant Librarian Surgeon General's Library, Army Medical Museum, Co-Editor Index Medicus; Editor-in-Chief, Washington, D. C. Washington D. C.: Interpreter Publishing Company.

Southern Medical News

ALABAMA

Dr. Marcus Crew Hunt, Fairfax, and Miss Libbie Janet Bross, Mixbury, were married recently.

Dr. Wiley Terrell Simpson, Eufaula, and Miss Emma Elizabeth Rish, Coleman, Ga., were married February 28.

Deaths

Dr. Thomas C. Bozeman, Gantt, aged 65, died March 13 from cardiorenal disease.

Dr. Emmett Kimbrough Moon, Birmingham, aged 57, died March 6 from pneumonia.

ARKANSAS

The Chamber of Commerce, Smackover, announces the erection of a $50,000 hospital.

The Sisters of Mercy, conducting the St. Joseph's Hospital at Hot Springs, announce the erection of a $250,000 annex to their present hospital structure.

Drs. J. B. and S. R. Crawford, Little Rock, have been appointed eye, ear, nose and throat specialists for the Arkansas School for the Blind, succeeding Dr. W. T. McCurry, deceased.

Dr. Austin F. Barr, Health Officer of Beauregard Parish, La., was recently appointed officer-in-charge of the full-time Health Department of Hot Springs.

Dr. E. C. Pyatt was recently named full-time Health Officer for Jefferson County.

Dr. Maurice F. Lautman, Hot Springs, and Miss Minnie Edelstone, Chicago, Ill., were married April 6.

Deaths

Dr. Carroll T. Chandler, Marianna, aged 66, died January 11.

Dr. Elsie R. Schmitz, Green Forest, aged 68, died February 3 from cerebral hemorrhage.

Dr. Wm. T. McCain, McCrory, aged 60, died suddenly March 26 from heart disease.

DISTRICT OF COLUMBIA

Dr. John T. Sprague, for two years chief of the division of contagious disease, District Health Department, has resigned and will engage in private practice. He will be succeeded by Dr. James G. Cumming, formerly of the Health Department of Philadelphia.

Surgeon-General Merritte W. Ireland, U. S. Army, recently left for the Panama Canal Zone for the annual inspection of hospitals and sanitation.

Deaths

Dr. William T. Baldus, Washington, aged 77, died March 24.

FLORIDA

Deaths

Dr. Angus James Smith, St. Petersburg, aged 46, died February 22 from pneumonia.

Dr. Harlow Ashton Boyle, Tampa, died March 17.

GEORGIA

Baldwin County Medical Society has elected Dr. N. P. Walker, Milledgeville, President; Dr. W. M. Scott, Deveraux, Vice-President; Dr. H. D. Allen, Jr., Milledgeville, Secretary-Treasurer.

Ben Hill County Medical Society has elected Dr. W. P. Coffee, Fitzgerald, President; Dr. E. A. Russell, Fitzgerald, Vice-President; Dr. L. S. Osborne, Fitzgerald, Secretary-Treasurer.

Bibb County Medical Society has elected Dr. Benjamin Bashinski, Macon, President; Dr. O. R. Thompson, Macon, Vice-President; Dr. R. S. Muckenfuss, Macon, Secretary-Treasurer.

Clarke County Medical Society has elected Dr. Harold I. Reynolds, Athens, President; Dr. C. J. Decker, Athens, Vice-President; Dr. Thos. Bolling Gay, Athens, Secretary-Treasurer.

Cobb County Medical Society has elected Dr. W. H. Perkinson, Marietta, President; Dr. F. P. Lindley, Powder Springs, Vice-President; Dr. R. W. Fowler, Marietta, Secretary-Treasurer.

Coffee County Medical Society has elected Dr. Geo. M. Ricketson, Broxton, President; Dr. W. F. Sibbett, Douglas, Vice-President; Dr. T. H. Clark, Douglas, Secretary-Treasurer.

Decatur-Seminole County Medical Society has elected Dr. S. A. V. Christiphine, Attapulgus, President; Dr. W. L. Wilkinson, Bainbridge, Vice-President; Dr. L. W. Willis, Bainbridge, Secretary-Treasurer.

DeKalb County Medical Society has elected Dr. Mary F. Sweet, Decatur, President; Dr. J. C. Daniel, Decatur, Vice-President; Dr. J. F. Pitman, Decatur, Secretary-Treasurer.

Dooly County Medical Society has elected Dr. R. H. Pate, Unadila, President; Dr. J. L. Lee, Pinehurst, Vice-President; Dr. F. E. Williams, Vienna, Secretary-Treasurer.

Emanuel County Medical Society has elected Dr. J. D. Bailey, Summertown, President; Dr. J. M. Nunez, Swainsboro, Vice-President; Dr. S. S. Youman, Oak Park, Secretary-Treasurer.

Floyd County Medical Society has elected Dr. Robert O. Simmons, Rome, President; Dr. A. F. Routledge, Vice-President; Dr. J. Harry Mull, Rome, re-elected Secretary-Treasurer.

Forsyth County Medical Society has elected Dr. W. E. Lipscomb, Cummings, President; Dr. Marcus Mashburn, Cummings, Secretary-Treasurer.

Johnson County Medical Society has elected Dr. T. L. Harris, Wrightsville, President; Dr. D. C. Harrison, Kite, Vice-President; Dr. J. G. Brantley, Wrightsville, Secretary-Treasurer.

Jones County Medical Society has elected Dr. J. H. Riley, Haddock, President; Dr. P. R. Chambliss, Gray, Secretary-Treasurer.

Lamar County Medical Society has elected Dr. C. E. Suggs, Barnesville, President; Dr. J. M. F. Barron, Milner, Vice-President; Dr. J. M. Anderson, Barnesville, Secretary-Treasurer.

Macon-Taylor County Medical Society has elected Dr. C. A. Greer, Oglethorpe, President; Dr. R. C. Montgomery, Butler, Vice-President; Dr. F. M. Mullinc, Montezuma, Secretary-Treasurer.

Morgan County Medical Society has elected Dr. W. M. Fambrough, Bostwick, President; Dr. W. C. McGeary, Madison, Vice-President; Dr. D. M. Carter, Madison, Secretary-Treasurer.

Ocmulgee County Medical Society has elected Dr. W. A. Matthews, Hawkinsville, President; Dr. W. A. Coleman, Eastman, Vice-President; Dr. W. H. Pirkle, Cochran, Secretary-Treasurer.

Polk County Medical Society has elected Dr. S. L. Whiteley, Cedartown, President; Dr. C. W. Peek, Cedartown, Vice-President; Dr. John W. Good, Cedartown, Secretary-Treasurer.

Spalding County Medical Society has elected Dr. K. S. Hunt, Griffin, President; Dr. W. C. Miles, Griffin, Vice-President; Dr. T. I. Hawkins, Griffin, Secretary-Treasurer.

Upson County Medical Society has elected Dr. R. L. Carter, Thomaston, President; Dr. C. A. Harris, The Rock, Vice-President; Dr. B. C. Adams, Thomaston, Secretary-Treasurer.

Walton County Medical Society has elected Dr. H. L. Upshaw, Social Circle, President; Dr. J. B. H. Day, Social Circle, Vice-President; Dr. J. K. McClintic, Monroe, Secretary-Treasurer.

Washington County Medical Society has elected Dr. T. B. King, Sandersville, President; Dr. B. O. Joiner, Tennille, Vice-President; Dr. N. Overby, Sandersville, Secretary-Treasurer.

Whitfield County Medical Society has elected Dr. Trammel Starr, Dalton, President; Dr. J. C. Rollins, Dalton, Vice-President; Dr. B. L. Kennedy, Dalton, Secretary-Treasurer.

Second District Medical Society met March 12 at Bainbridge. Dr. C. K. Sharp, Arlington, was elected President; Dr. J. A. Summerlin, Hartfield, Vice-President; Dr. A. W. Wood, Albany, re-elected Secretary-Treasurer.

Fifth District Medical Society has elected Dr. W. F. Wells, Hapeville, President; Dr. D. Houseworth, Douglasville, Vice-President; Dr. John B. Fitts, Atlanta, Secretary-Treasurer.

Ninth District Medical Society has elected Dr. J. R. Simpson, Gainesville, President; Dr. Edson W. Glidden, Alto, Vice-President; Dr. J. C. Bennett, Jefferson, Secretary-Treasurer.

Dr. M. M. McCord has been appointed President of the Emory University Alumni Association for Rome.

A County Health Department has been organized in Ware County. An appropriation of $6,000 has been made jointly by Ware County and Waycross for the purpose of equipping a laboratory and defraying the expenses of the Department. The Department was organized under the requirements of the Ellis Health Bill.

The McCrackin Sanitarium, Baxley, has been opened. Dr.

H. C. McCrackin owns the sanitarium and he has associated with him Drs. John M. Hall, Hazlehurst, P. H. Comas, Baxley, W. C. Pirkle, Baxley, W. D. Brach, Baxley, and J. L. Weaver, Baxley.

Dr. C. F. Griffith, Griffin, has been appointed to complete the Staff of the Griffin Hospital. Other members of the staff are Drs. J. R. Anthony, A. H. Frye, W. C. Miles, K. S. Hunt, T. I. Hawkins, L. M. Gable and Webb Conn.

Dr. Thomas D. Coleman has been appointed a medical officer with the rank of Colonel, in the United States Army.

Dr. William H. Myers, Savannah, has been re-elected Chairman of the Health Center.

Dr. J. D. Applewhite, Athens, County Health Officer, has been appointed on the Committee to select a site and supervise the construction of the $50,000 tuberculosis hospital for Clarke County.

The following have been named on the Georgia Governing Committee of the Gorgas Memorial Institute: Drs. Wm. M. Folks, Waycross, Marion T. Benson, Atlanta, G. Pope Huguley, Atlanta, O. H. Matthews, Atlanta, Geo. H. Noble, Atlanta, and Dunbar Roy, Atlanta.

Dr. Forest L. Cosby, Jr., formerly of Miami, Fla., will be in charge of the orthopedic service in the City Hospital, Columbus.

Dr. Walter E. Mobley and Miss Frances Johnson, both of Macon, were married February 15.

Deaths

Dr. William J. McNaughton, Atlanta, aged 65, died March 12 at the Grady Hospital, from chronic interstitial nephritis and cerebral hemorrhage.

Dr. Hubert Sheppard, Atlanta, died February 23 at the Wesley Memorial Hospital from blood poisoning following a prick of the finger during an autopsy.

Dr. Luther Park Stephens, Atlanta, aged 62, died March 18 at Brunswick.

KENTUCKY

The County Board of Health, Bowling Green, has elected Dr. Walter C. Simmons, Smiths Grove, President; Dr. Charles E. Francis, Bowling Green, Secretary-Treasurer.

It was reported on April 6 that the epidemic of typhoid fever at the mining town of Wolfpit amounted to seventy-six cases, and that there had been five deaths.

Dr. William Burr Atkinson, Campbellsville, and Miss Sallie Wade, Knoxville, Tenn., were married recently.

Deaths

Dr. David Short Goodloe, Lexington, aged 80, died February 1.

Dr. Lew G. Wallace, Bellevue, aged 57, died March 3 from pneumonia.

Dr. Lossie Edmond Gilbert, Carresville, aged 42, died March 3 at the Riverside Hospital, Paducah.

Dr. Thomas Cole Holloway, Lexington, aged 51, died March 16.

Dr. Moreau S. Browne, Winchester, aged 80, died March 2, following a long illness.

Dr. James C. Douglass, Franklin, aged 77, died March 25 at an infirmary in Nashville, Tenn., from cerebral hemorrhage.

LOUISIANA

At the annual meeting of the Louisiana State Medical Association held in New Orleans, April 21, Dr. E. M. Ellis, Crowley, was installed as President: Dr. Stephen M. Blackshear, New Orleans, was elected President-elect; Drs. Hector E. Bernadas, New Orleans, and Carl A. Weiss, Baton Rouge, New Councilors; Dr. Oscar Dowling and Arthur A. Herold, Shreveport, and Drs. Hermann B. Gessner, Adolph O. Hoefeld and Hiram W. Kostmayer, New Orleans, Publication Committee of the Journal. The next meeting will be held in Monroe.

Members of the Touro Infirmary and Hebrew Association, it has been reported, recently voted to issue $650,000 in bonds, $350,000 of which will be marketed at once to

(Continued on page 34)

You Owe Yourself Some New Books

McKENDRICK and WHITTAKER—An X-Ray Atlas of the Normal and Abnormal Structures of the Body

By ARCHIBALD McKENDRICK, F.R.C.S., (Edin.), D.P.H., F.R.S.E. Surgeon in charge of the Surgical X-Ray Department, Royal Infirmary, Edinburgh; Examiner, Royal College of Surgeons, Edinburgh; and CHARLES R. WHITTAKER, F.R.C.S. (Edin.), F.R.S.E. Assistant Lecturer on Anatomy, Surgeon's Hall, Edinburgh; Examiner, Royal College of Surgeons, Edinburgh. Large quarto, 240 pages, with 388 radiograms and 25 line drawings. Price $10.00 net. *Just Published.*

The success and high appreciation of Bertwistle's-Atlas of Radiographs of the Bones and Joints produced a strong demand for a good radiographic atlas including other parts of the body, and here it is. The authors have provided a series of excellent clear radiograms illustrating the normal and abnormal structures of the body, also the more common injuries and diseases. While it is true that radiographic interpretation can only be satisfactorily learned from a careful study of actual negatives, and by assisting at "screen" examinations, to those who have not these facilities a good atlas is essential. The average practitioner frequently has difficulty in perceiving in the radiogram furnished to him just what the conditions really are and to be able to make comparison is a great help. The contents include: Normal Joints of the Limbs-Injuries and Diseases of the Limbs-Head, Neck, Thorax, and Spine-Abdomen-Appendix.

BIGGER—Handbook of Bacteriology

By JOSEPH W. BIGGER, M.D., F.R.C.P.I., D.P.H. Professor of Bacteriology, University of Dublin; Bacteriologist Rotunda Hospital, Sir Patrick Dun's Hospital, and the Royal City of Dublin Hospital; Formerly Professor of Preventive Medicine, Royal College of Surgeons, Ireland, etc. Octavo, 429 pages, 5 colored plates, 66 text illustrations. $5.00 net.

Professor Bigger has produced an entirely new handbook of Bacteriology to meet the complaint that most of the text-books of the subject are so bulky that the student has not sufficient time to master their contents in the short time devoted to the study of Bacteriology in the medical curriculum, and further that he is unable to distinguish the more important matter from the less. This work is primarily intended for medical students and those practitioners who have not specialized in Bacteriology.

WHEELER—Handbook of Operative Surgery

By SIR WILLIAM IRELAND DE COURCY WHEELER, B.A., M.D., F.R.C.S.I., F.A.C.S. Surgeon to Mercer's Hospital and the National Children's Hospital, Dublin. Fourth edition, 16 mo, 457 pages, 298 illustrations. $5.50 net. *Now ready.*

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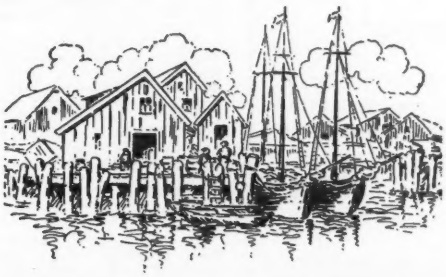

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Cincinnati, Ohio.

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provide for expansion. The remainder will be kept until the public donates a like amount, when it will be used in further expansion.

The following have been appointed members of the State Board of Health representing congressional districts as indicated: Dr. Adolph O. Hoefeld, New Orleans, first; Dr. Michael P. Boebinger, New Orleans, second; Mr. T. J. Labbe, St. Martinsville, third; Fred Ratzburg, D. D. S., Shreveport, fourth; Dr. Thomas E. Wright, Monroe, fifth; Mrs. L. C. McVoy, Baton Rouge, sixth; Dr. Theophilus T. Tarlton, Grand Coteau, seventh; Dr. Edgar S. Matthews, Bunkie, seventh; Dr. Oscar Dowling, New Orleans, at large.

Dr. Stephen R. Coleman, New Orleans, and Miss Irene Hale, Tampa, Fla., were married April 6.

Deaths

Dr. Joseph M. Hubert, New Orleans, aged 50, died suddenly, March 1 at the Touro Infirmary, from heart disease.

Dr. Israel C. Oden, Shreveport, aged 57, died March 9 at Washom, Texas.

Dr. John Malcolm Oglesby, Alexandria, aged 48, died March 9 at the Baptist Hospital, from injuries received when the automobile in which he was driving overturned.

Dr. Carel Lafayette Brewster, Alexandria, aged 42, died March 13.

MARYLAND

A joint meeting of the Baltimore City Medical Society and the Medical Society of the District of Columbia was held April 15, in Washington.

Johns Hopkins Hospital plans to construct a new dispensary which is said to be the largest and most adequately equipped of its kind in this country. The building will adjoin the present pathology building. The Carnegie Corporation, New York, has contributed $1,000,000 for construction, and an additional $1,000,000 for endowment.

A mental hygiene clinic under the direction of the State Board of Mental Hygiene was opened at Hagerstown recently. Dr. Henry S. Mitchell, Director of the Foster Clinic,

(Continued on page 36)

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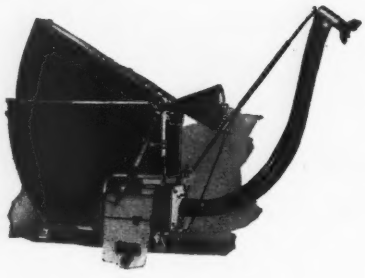

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(Continued from page 34)

Spring Grove State Hospital, and Fannie C. Haines, Director of County Mental Hygiene Clinics, Board of Mental Hygiene, will be in charge.

The new nurses home to be constructed for Johns Hopkins Hospital will cost approximately $650,000 and will be eight stories high. It will accommodate about 240 nurses.

The staff of the Johns Hopkins Medical School gave a dinner in honor of Dr. Joseph C. Bloodgood, Surgeon in Chief, St. Agnes Hospital, Baltimore, and Associate Professor of Surgery, Johns Hopkins Medical School, on his return from Egypt.

Dr. May Thorne, Royal Free Hospital for Women, London, is visiting in Baltimore in the interest of the Washington Ward of that hospital, in which Americans in England are interested. Since her arrival in this country more than $6,000 has been obtained by Dr. Thorne for the ward.

Dr. Dean Lewis, Chief Surgeon, University of Illinois, has accepted the position as Chief Surgeon at Johns Hopkins University, Baltimore.

Dr. Frederick H. Baetjer, recently underwent an operation for the removal of an infected finger, which had been burned in roentgen-ray work. Roentgen-ray injuries have caused Dr. Baetjer to lose eight fingers and an eye. He is a member of the staff of Johns Hopkins Hospital and Medical School.

Dr. Warren H. Hoak, Medical Officer in Charge, U. S. Public Health Service, Customs House, Baltimore, has resigned and will return to private practice in Baltimore.

Dr. James H. Ulrich, Baltimore, has been commissioned a Colonel in the Medical Corps of the Officers Reserve Corps, U. S. Army.

Dr. William Wilmer, Washington, D. C., has been appointed as full-time Professor of Ophthalmology in Johns Hopkins Medical School, Baltimore, and as Ophthalmologist in Chief of the Wilmer Eye Institute, to be established at the Johns Hopkins Hospital.

Deaths

Dr. Arminus Cleveland Pole, Baltimore, aged 72, died March 31 at the Maryland General Hospital.

Dr. Samuel Jayne Fort, La Plata, aged 65, died March 26 from pneumonia.

(Continued on page 38)

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(Continued from page 36)

MISSISSIPPI

Deaths

Dr. Benjamin N. Ward, Como, died at Rochester, Minn., in March.

Dr. W. T. Street, Rose Hill, aged 71, died March 17 from cerebral hemorrhage.

Dr. J. W. Walker, Longwood, aged 60, died March 15 at a sanatorium in Greenville from pneumonia.

MISSOURI

Dunklin County Medical Society has elected Dr. J. D. Van Cleve, Malden, President; Dr. C. W. Brown, Kennett, Vice-President; Dr. T. J. Rigdon, Kennett, Secretary-Treasurer.

Henry County Medical Society has elected Dr. Robt. D. Haire, Clinton, President; Dr. Wm. Kelly, Clinton, Vice-President; Dr. E. C. Peelor, Clinton, Secretary-Treasurer.

Schuyler County Medical Society has elected Dr. A. J. Drake, President; Dr. H. E. Gerwig, Vice-President; Dr. J. B. Bridges, Secretary-Treasurer.

The annual banquet of the Jackson County Medical Society was held April 7, at Kansas City, in honor of members who have been in practice more than fifty years, and of former presidents of the Society.

The Kansas City Academy of Medicine has elected Dr. Ralph H. Major, President; Dr. Michael J. Owen, Vice-President; Dr. Frank R. Teachenor, Secretary.

Through the recent death of Sir W. Northrup McMillan, former St. Louis capitalist, at Nice, France, in March, Washington University, St. Louis, will receive more than a million dollars for the establishment of a hospital to be known as the "McMillan Eye, Ear, Nose and Throat Hospital." Mr. McMillan's mother, who died in 1914, provided that should her son die without issue, the residue of her estate should go for this purpose.

At the request of the American Red Cross, St. Louis Medical Society has taken charge of medical and nursing aid in the tornado area. Following an inspection by the

(Continued on page 40)

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(Continued from page 38)

President and Secretary of the St. Louis Medical Society, five members were sent into the devasted area.

Dr. Thomas A. Son, Bonne Terre, and Dr. Ethan E. Brunner, Marshall, have resigned as members of the State Board of Health. Dr. Homer L. Kerr, Crane, and Dr. Herman S. Gove, Linn, have been appointed to fill the vacancies.

Deaths

Dr. William T. Bohannon, Nevada, aged 83, died February 14.

Dr. Paul C. Scholz, St. Louis, aged 64, was killed March 7 in an automobile accident.

Dr. Robert W. Amos, Joplin, aged 64, died March 2 from carcinoma of the pancreas.

Dr. Albert B. Vogel, St. Louis, aged 50, died in March.

Dr. Robert H. Conaway, Stone Hill, aged 72, died February 7 at Dillard from abscess of the liver.

Dr. Caruthers A. Anthony, Fredericktown, aged 66, died March 2 from heart disease.

Dr. Coray A. Nickell, Mayview, aged 53, died March 2 at the Research Hospital, Kansas City, from injuries received when the automobile in which he was driving was struck by a train.

Dr. Frank H. Kallmeyer, Glasgow, aged 69, died March 17 from heart disease.

Dr. William Davis Foster, Kansas City, aged 83, died February 5.

Dr. Herman W. Faver, St. Louis, aged 59, died April 1.

Dr. Channing L. Pryor, Maywood, aged 69, died March 13.

NORTH CAROLINA

The Fifth District Medical Society held the largest meeting in its history at the Country Club, Fayetteville, April 15, the occasion being an old-fashioned barbecue in "true Southern style."

The University of North Carolina extension department, announces plans for another session of the Post graduate School for Physicians. Last year an instructor visited Pinehurst, Durham, Sanford, Hamlet, Lumberton and Fayette-

(Continued on page 42)

The "MESCO" Laboratories manufacture the largest line of Ointments in the world. Sixty different kinds. We are originators of the Professional Package. Specify "MESCO" when prescribing Ointments. Send for lists.

Manhattan Eye Salve Company
Louisville, Ky.

Analysis of

KLIM

POWDERED WHOLE MILK

	Dry	Liquid *
BUTTERFAT	28.00%	3.33%
CASEIN	21.28%	2.53%
ALBUMIN	5.46%	.65%
LACTOSE	38.00%	4.53%
ASH	3.76%	.69%
WATER	1.50%	88.27%
CALORIES (*per ounce*)	149.	18.

* 4½ Ounces to a quart of water

KLIM is completely soluble in water of any temperature

When Used in Infant Feeding

Reliquified KLIM *at normal strength has the same analysis and caloric value as natural whole cow's milk and is subject to the same modifications when used in infant feeding*

Recognizing the importance of scientific control, all contact with the laity is predicated on the policy that KLIM be used in infant feeding only according to a physician's formula.

KLIM has a high nutritive and assimilative index

THE casein of KLIM, when attacked by digestive juices, coagulates in a flocculent mass rather than in the tough curds characteristic of natural milk.

The butterfat of KLIM retains the globular form of natural milk, but in a much finer division.

The result must be a speedier and more complete metabolism, less inclination to colic, and an absence of the regurgitation which frequently accompanies the feeding of natural milk.

Literature and samples sent promptly on request

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Also Makers of Merrell-Soule Powdered Protein Milk

In Canada KLIM and Powdered Protein Milk are made by Canadian Milk Products, Ltd., 347 Adelaide Street, West, Toronto.

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Prepared Casein

DIABETIC FLOUR

(Accepted by The Council A. M. A.)

LISTERS prepared casein DIABETIC FLOUR is strictly free from Starch, Sugar and Gluten. It is put up in individual boxes, sufficient flour in each box to make a loaf of bread, six muffins, biscuits, etc. Easy to follow recipes in each carton. Foods are palatable and attractive.

Large Carton Flour *(30 individual boxes)* $4.85
Small Carton Flour *(15 individual boxes)* $2.75

At leading druggists or direct

LISTER BROS., Inc.
405 Lexington Avenue New York City

(Continued from page 40)

ville, and another instructor visited Rutherfordton, Shelby, Charlotte, Concord, Gastonia, and Lincolnton one day a week for twelve weeks, to give courses in pediatrics.

The new hospital building, Albemarle, has been completed at a cost of $100,000. Half of this amount was raised by stock subscriptions and the other half by the general public and by physicians of the county. The following officers have been selected: Dr. Julius C. Hall, President; Dr. Wm. T. Shaver, Vice-President; Dr. Lucius V. Dunlap, Secretary-Treasurer.

The Mecklenburg County authorities have selected a 100 acre site 12 miles from Charlotte, on the Statesville highway, for a tuberculosis sanatorium which will cost $100,000.

Expending of the $800,000 appropriated by the last legislature for a building program during the next two years has been provided for by the Executive Committee of the State University Board of Trustees.

The medical staff of the U. S. Veterans' Bureau at Oteen has organized a medical society. Colonel Whitledge, Commanding Officer, is Honorary President; Dr. David Kramer, President; Dr. George S. Spence, Vice-President; Dr. Frederick C. Locke, Secretary; Dr. Vernon L. Mahoney, Treasurer.

The Parrott Memorial Hospital, Kinston, will soon erect an addition which will cost more than $75,000.

The new Davis Hospital, Statesville, is under construction. It will be four stories with a capacity of fifty patients.

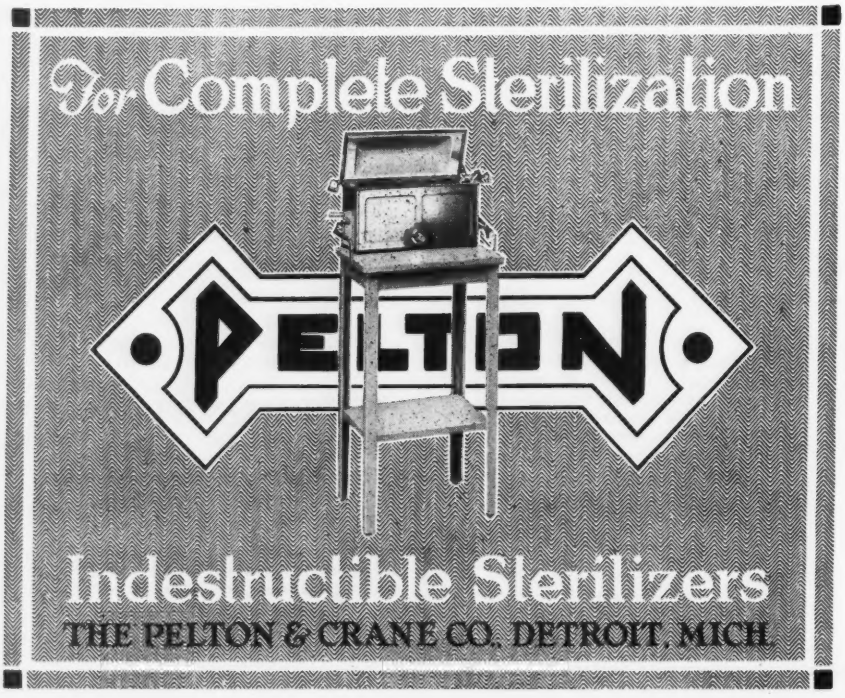
The Good Samaritan Hospital, for colored people, Charlotte, announces the completion of additions, which increase its bed capacity from thirty to sixty. They have asked the community for $6,000 for furnishings. The institution was established and is controlled by white citizens. It has functioned for thirty years, and this is its first appeal to the community for funds.

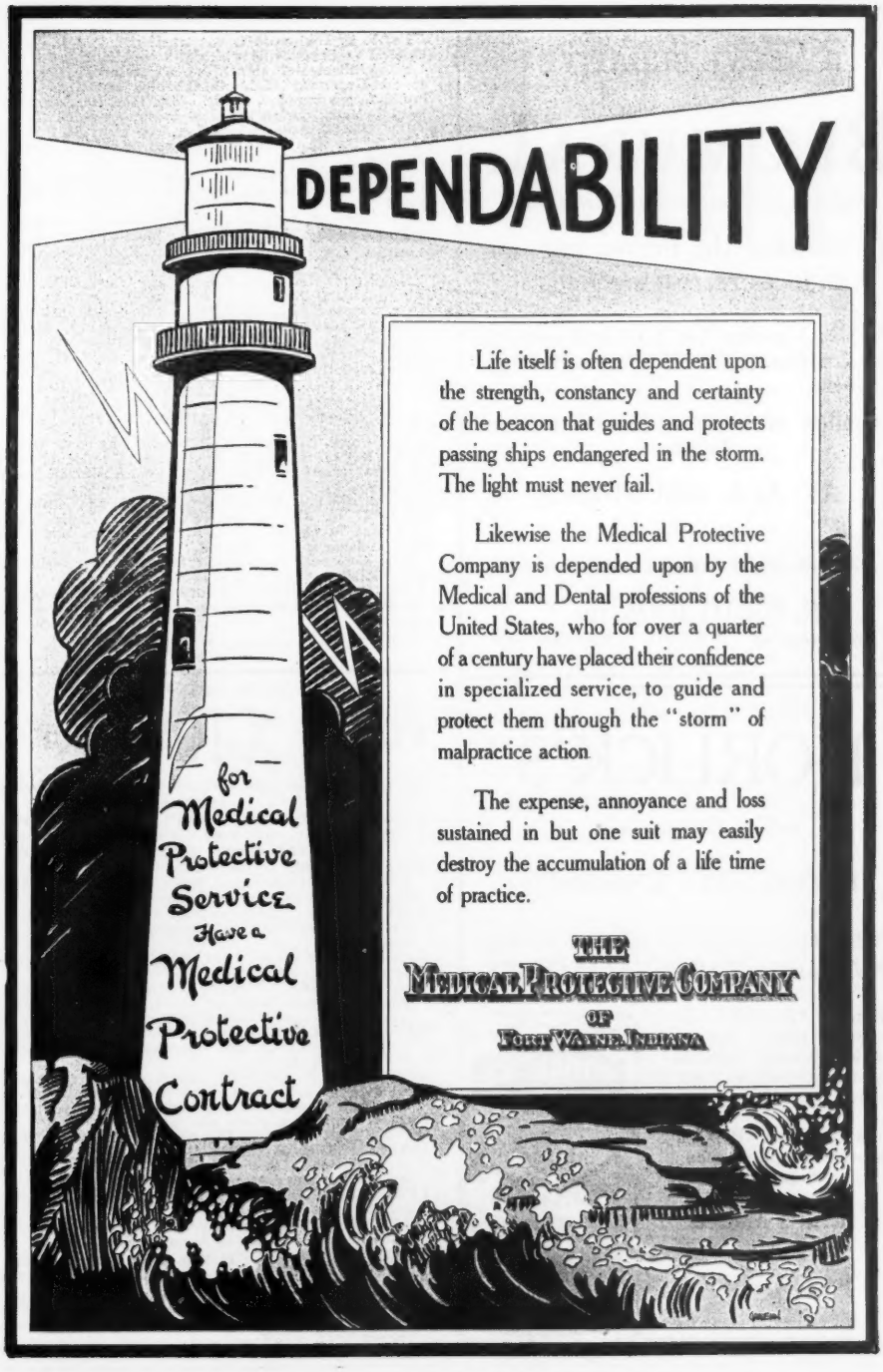
Dr. Parran Jarboe was recently elected President of the staff of St. Leo's Hospital, Greensboro; Dr. Ralph E. Dees, Vice-President; Dr. Robert A. Herring, Secretary.

Drs. James C. Grady, Kenly, and Allen McLean, Wagram, have been appointed Trustees of the State Normal School, Fayetteville.

Dr. Hamilton W. McKay, Crowell Clinic, Charlotte, was recently appointed Director of the Mecklenburg Industrial Home.

(Continued on page 44)




DEPENDABILITY
Life itself is often dependent upon the strength, constancy and certainty of the beacon that guides and protects passing ships endangered in the storm. The light must never fail.
Likewise the Medical Protective Company is depended upon by the Medical and Dental professions of the United States, who for over a quarter of a century have placed their confidence in specialized service, to guide and protect them through the "storm" of malpractice action.
The expense, annoyance and loss sustained in but one suit may easily destroy the accumulation of a life time of practice.
for Medical Protective Service Have a Medical Protective Contract
THE MEDICAL PROTECTIVE COMPANY OF FORT WAYNE, INDIANA

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BROMURAL

(Alpha-monobrom isovaleryl-carbamide)

Soothes the nerves and induces refreshing sleep

DOSE: 5 grains (or 1 tablet) several times a day. 10 to 15 grains in sleeplessness

Supplied in 5 grain Tablets and in Powder

AT ALL DRUGGISTS

Literature and Samples upon Request

E. BILHUBER, Inc.

25 West Broadway New York, N. Y.

"HORLICK'S"

—The Original—

EXTENSIVELY ENDORSED

FOR THE FEEDING OF INFANTS, INVALIDS AND CONVALESCENTS

(Specify "Horlick's" in order to obtain the reliable results insured by the Original product).

Samples and Printed matter prepaid upon request

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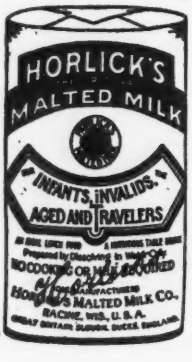
Racine, Wis.



(Continued from page 42)

Dr. J. F. Highsmith is constructing a half million dollar hospital at Fayetteville which will contain about 100 rooms.

Dr. William DeB. MacNider, Professor of Pharmacology at the University of North Carolina, served as Physician-in-Chief, pro tempore, at the Peter Bent Brigham Hospital, Boston, Mass., during the week beginning April 12.

Dr. Cola Castelloe, Aulnader, has resigned his commission in the U. S. Navy and will locate in Ahoskie for practice.

Dr. Thomas Preston White, Charlotte, and Miss Henrietta Tucker, Lexington, Va., were married at Winter Park, Fla., March 21.

Dr. Claudius A. Street, Winston-Salem, and Miss Julia Lilly Montgomery, Raleigh, were married recently.

Deaths

Dr. Hector Lanchlin MacFayden, Waynesville, aged 77, died February 27.

Dr. James R. Campbell, Newton, aged 75, died March 2.

Dr. Thaddeus O. Joyner, Severn, aged 48, died March 21 at Suffolk, Va., from pneumonia.

Dr. Joseph Edwin Wilson, Canton, aged 67, died February 16 from heart disease.

OKLAHOMA

The Tulsa Academy of Ophthalmology and Oto-Laryngology has elected Dr. T. W. Stallings, President; Dr. Chas. H. Haralson, Vice President; Dr. W. A. Huber, Secretary-Treasurer.

Payne County Medical Society held an infant clinic March 11 at Ripley. Dr. William M. Taylor, Oklahoma City, was in charge. Drs. R. T. Edwards and Clark H. Hall, Oklahoma City, assisted.

Drs. Colwick and Colwick, Durant, are erecting a two story building to be used as a nurses' home.

The Weedn Hospital, Waurika, which was partially destroyed by fire sometime ago, has been rebuilt and newly equipped.

(Continued on page 46)

SAVE MONEY ON

YOUR X-RAY SUPPLIES

Get our price list and discounts on quantities before you purchase

HUNDREDS OF DOCTORS FIND WE SAVE THEM FROM 10% TO 25% ON X-RAY LABORATORY COSTS.

AMONG THE MANY ARTICLES SOLD ARE:

X-RAY PLATES. Three brands in stock for quick shipment. **PARAGON** Brand for finest work; **UNIVERSAL** Brand, where price is important.

X-RAY FILMS. Duplitized or Dental—all standard sizes. Eastman, Ilford or X-ograph metal backed. Fast or slow emulsion.

BARIUM SULPHATE. For stomach work. Finest grade. Low price.

COOLIDGE X-RAY TUBES, 5 styles, 10 or 30 milliamp.- Radiator (small bulb), or broad, medium or fine focus, large bulb. Lead Glass Shields for Radiator type tubes.

DEVELOPING TANKS. 4 or 6 compartments, stone tanks. These will end your dark room troubles. 5 sizes of Enameled Steel Tanks.

DENTAL FILM MOUNTS. Black or gray cardboard with celluloid window or all celluloid type, one to eleven film openings. Special list and samples on request. Price includes imprinting name and address.

DEVELOPER CHEMICALS. Metol, Hydroquinone, Hypo, etc.

INTENSIFYING SCREENS. Patterson TE, or celluloid-backed screens. Reduce exposure to ¼th or less. Double screens for film. All-metal cassettes.

LEADED GLOVES AND APRONS. (New type glove, lower priced.)

FILING ENVELOPES with printed X-ray form. (For used plates.) Order direct or through your dealer.

If You Have a Machine Get Your Name on our Mailing List.

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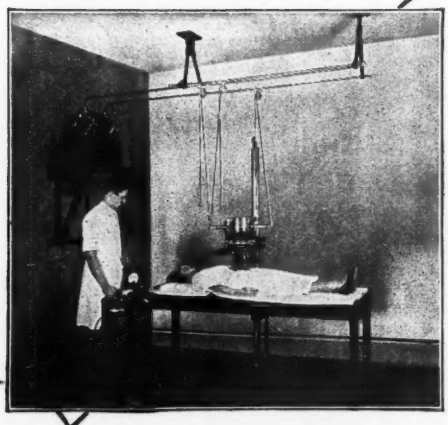
Southern Branch, 324 Godchaux Bldg., New Orleans

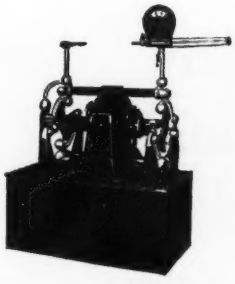


Six-Sixty Generator with Horizontal Table being used for Radiography

RADIOGRAPHY

with the SIX-SIXTY

Coronaless Roentgen Generator



100 Kilovolts at 60 Milliamperes

ONLY after actual trial can the Roentgenologist appreciate the unsurpassed ease of control, extreme flexibility and the utmost convenience of the Acme International Six-Sixty Coronaless Generator.

Of such a size that it can be readily mounted in the smallest laboratory, it has ample capacity for all radiographic and fluoroscopic work and equal, if not greater capacity, than that of many much larger machines.

While scarcely larger than the ordinary 5"-30 M. A. transformer for self-rectifying tubes it delivers more *rectified* current at a higher voltage.

With its size and capacity it presents the solution of the problem of installing efficient X-Ray apparatus in the office or laboratory where space is limited.

Illustrated descriptive literature on request

ACME INTERNATIONAL X-RAY CO.

347 West Chicago Avenue, Chicago, Illinois

Sales and Service Representatives in All Localities

Exclusive Manufacturers of Precision Type Coronaless Apparatus

(Continued from page 44)

Dr. William H. Bailey, Oklahoma City, has resigned as Director of the Bailey-Keller Laboratory, which is now known as the Medical Arts Laboratory, and will give his entire time to the Wesley Hospital Laboratory, of which he has been director for several years.

Dr. W. H. Davidson, Cushing, has been appointed as Assistant Surgeon of the Katy Railroad at Cushing, having charge of the Eye, Ear, Nose and Throat department.

Dr. G. W. Wiley, Norman, has been elected President of the Norman Golf and Country Club.

Dr. William D. Atkins, Holdenville, has been reappointed Superintendent of Public Health of Hughes County. He has held this position for ten years.

Dr. William H. Bailey, Editor of the Oklahoma County Medical Association's Medical Bulletin, has resigned. The President of that Association succeeds him.

Deaths

Dr. Fernando Cortez Rose, Allen, aged 50, died March 3 at the Ada Hospital, Ada, from injuries received in an automobile accident.

Dr. J. G. Street, Oklahoma City, aged 78, died February 15 at the Wesley Hospital.

Dr. Virgil O. Wood, Blackwell, aged 75, died March 19 from pneumonia.

SOUTH CAROLINA

Dr. L. A. Riser, Director, Rural Sanitation and County Health Work, Columbia, reports that South Carolina now stands at the top in rural health work. Fifty per cent of the people living in the rural districts in the state are protected by full time County Health Departments. The following counties have full time County Health Departments: Orangeburg, Darlington, Charleston, Fairfield, Newberry, Cherokee, Aiken, Anderson, Greenville, Dillon, Colleton, Beaufort, Marion and Georgetown. Spartanburg and Greenwood Counties are putting on departments this year. Beaufort, Marion and Georgetown are under the Department of Malarial Control.

(Continued on page 48)

What they will eat

Prescribe Puffed Grains to coax appetite back

WHEN convalescents refuse to take an interest in food, Quaker Puffed Grains often help coax back appetite.

Puffed Wheat and Puffed Rice are tempting dainties when offered with sugar and cream, or floated in a bowl of milk. They are so light, so airy, so delicately fragile, that it is hard to realize that they are such nutritious grains—rich wheat and rich rice—steam exploded to eight times normal size!

This breaking up of every tiny food cell assures easy digestion and assimilation. And, equally important, enjoyment of Puffed Grains encourages the liberal allowance of cream and milk so necessary in body-building.

Children enjoy Puffed Wheat and Puffed Rice, regarding them as confections which they are allowed to eat without restraint. When your little patients rebel at their daily allowance of what seems to them plainer, heartier food, advise mothers to make breakfast and luncheon seem more attractive by the introduction of Quaker Puffed Grains.

Quaker Puffed Wheat
Quaker Puffed Rice

Erythrol Tetranitrate Merck

Asthma
Angina Pectoris
Arteriosclerosis
Cardiac Diseases

Literature on request

Merck & Co.

45 PARK PLACE NEW YORK

Someone on lookout

The Profession has never dropped anchor (and never will)! It is a progress that cannot end—this service to humanity—going always onward, smooth or rough, through fog and fair sailing.

And the instruments the Profession uses, too, they must keep up. For they are the convoy; they are checking the course, and their soundings must be accurate, efficient, unfailing.

So it's good to know that someone is on lookout at each quarter—someone who is SPECIALIZING, making that their business.

In lanes of bloodpressure, the Baumanometer is right up for'd. It was created because an accurate bloodpressure instrument was needed (accurate, efficient and lasting). And now it is the one close study and intent to progress—to keep on providing the best in bloodpressure equipment.

To bring forth changes when changes are necessary; or refinements when refinements will increase the efficiency of the course. That is the task of the Baumanometer.

And with the full confidence of the Profession to justify—that is a labor of love indeed.

Baumanometer

"STANDARD FOR BLOODPRESSURE"

W. A. BAUM CO., Inc. 100 Fifth Avenue New York

Infant Mortality Rate Higher during THE SUMMER MONTHS

Liquid milk is apt to be dangerous to health—more so during the summer, because it decomposes more readily than any other food. Instead

use DRYCO the safe milk

Even when the ice supply fails, DRYCO keeps and is always uniform, safe and dependable. Many years of clinical history have demonstrated the fact that DRYCO is unexcelled in purity, quality, wholesomeness and nutritive value. Especially adapted to the feeding of infants and convalescents, it is also valuable as a general tonic and tissue builder. Available everywhere.

SAMPLES AND LITERATURE ON REQUEST

To save time, simply tear out this advertisement. pin it to your letter-head or Rx blank and mail to

THE DRY MILK COMPANY 18 PARK ROW, NEW YORK, N. Y.

(Continued from page 46)

The following counties employ dentists to do work in public schools: Aiken, Colleton, Laurens, Charleston, Darlington, Florence, Union, Lee, Orangeburg, Spartanburg and Sumter.

There are 57 public health nurses in the state working under the supervision of the Bureau of Public Health Nursing.

Dr. I. S. Barksdale, of the Physiology Department, Medical College of the State of South Carolina, Charleston, has been appointed Health Commissioner of Greenville, to succeed Clarence E. Smith, D. V. S., resigned.

Dr. Walter H. Shealy, Cherokee County Health Officer, has resigned and will engage in private practice.

Deaths

Dr. Willian Lee Hood, Greenwood, aged 59, died March 15 at Bartow, Fla., from cerebral hemorrhage.

TENNESSEE

Macon County Medical Society has elected Dr. A. Y. Kirby, LaFayette, President; Dr. D. D. Houser, LaFayette, Vice-President; Dr. F. B. Clark, Red Boiling Springs, Secretary-Treasurer.

Putnam County Medical Society has elected Dr. J. T. Moore, Algood, President; Drs. Z. L. Shipley, Cookeville, and J. MacWheeler, Baxter, Vice-Presidents; Dr. Lex Dyer, Cookeville, Secretary-Treasurer.

Sumner County Medical Society has elected Dr. J. M. Oliver, Portland, President; Dr. C. D. Robbins, Gallatin, Vice-President; Dr. L. M. Woodson, Gallatin, Secretary-Treasurer.

Washington County Medical Society has elected Dr. J. L. Hankins, President; Dr. H. D. Miller, Vice-President; Dr. Lee K. Gibson, Secretary-Treasurer.

The Rockefeller Foundation has donated $100,000 to the Medical Department of Vanderbilt University, Nashville, to be used over a period of five years for the development of the school of nursing that has been established in the Medical Department.

Dr. L. D. Fricks, Memphis, has been drafted by the Health Service Section of the League of Nations to rid Jugo-Slavia of persistent malaria. Dr. and Mrs. Fricks will sail for Europe May 12.

(Continued on page 50)

Oats Now the Quickest Breakfast —Doctor!

Will you help us spread the news?

HOT OATS porridge — rich, nutritious, sustaining — can now be served in three to five minutes!

We rely on you, Doctor, to help us tell wives and mothers this.

Quick Quaker is a new Quaker Oats —the same reliable Quaker they have always used. Only, now *quick-cooking.*

Quick Quaker is ready for the table even before the coffee.

In all, Quick Quaker settles the breakfast problem in every way.

Its food value you know as well or better than do we. That's why we're delighted to offer physicians Quaker Oats made quick-cooking.

Standard full size and weight packages—
Medium: 1¼ pounds;
Large: 3 pounds, 7 oz.

Cooks in 3 to 5 minutes

The kind you have always known

A NEW ACCURACY IN BLOOD PRESSURE READINGS
Baumanometer
So gravely important are blood pressure readings successful physicians take no chances. Thousands have laid aside old instruments and adopted the Baumanometer for greater accuracy.
$2.00 BRINGS IT TO YOU
BLOOD PRESSURE MANUAL
10 DAYS TRIAL
Employing Nature's Immutable Law Insures Absolute Accuracy
The unfailing reliability of gravitation method made use of. The scale of every instrument individually hand calibrated, another fundamental of scientific accuracy. Cannot spill; no air-pockets. The variation of other instruments of 10 to 30 mm. impossible.
Dr. Janeway, Johns Hopkins, Recommends It
Rockefeller Institute, Mayo Clinic, Yale and Harvard Medical Schools and many others use it. Metropolitan Life Insurance Co. bought 1000. Portable desk model (14½x4½x2½ inches). With Free Manual.
10 DAYS' TRIAL—EASY TERMS
Send just $2.00 and we will forward it to you at once. Try it. If not thoroughly satisfied return and get your money back. If perfectly satisfied, send the balance in ten monthly installments of $3.00 each; without interest—$32.00 in all complete, which is the regular cash price everywhere.
SIGN AND MAIL COUPON
A. S. ALOE CO., 581 OLIVE ST., ST. LOUIS, MO.
I enclose first payment, $2.00. Send Baumanometer complete on 10-days' trial. If I keep it, I will pay balance, $30.00, in 10 monthly payments of $3.00, without interest. I agree title remains in you until paid in full.
Name.....
Address.....

RADIUM

PLATINUM-IRIDIUM needles as developed by the Research Laboratories of the United States Radium Corporation are considered indispensable by many important Radium therapists.

YOUR RADIUM will be adapted to a greater variety of conditions if it is placed in the United States Radium Corporation small Platinum-Iridium needles.

OUR COOPERATION begins with Post Graduate instruction including clinical demonstrations at recognized institutions and continues to fulfill every need of Radium users.

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30 CHURCH STREET, NEW YORK — MINERS AND REFINERS OF RADIUM

Correspondence Solicited — U. S. Bureau of Standards' Measurements

NOTE: Please tear out this advertisement and return with your inquiry

THE PHYSIATRIC INSTITUTE

MORRISTOWN, N. J.

Devoted to the treatment and scientific investigation of metabolic disorders, especially diabetes, nephritis, hypertension and obesity.

Diabetes

The milder cases are still treated by diet without insulin. An accurate balanced diet is still necessary in the severe cases which receive insulin. Wrong or careless diet methods will give many bad results, which should not be blamed upon insulin. Institutional care is often important for study of the condition, breaking of wrong habits and instruction in diet. This Institute specializes in the individualized study and instruction of patients.

Nephritis and High Blood Pressure

The benefits of laboratory study and dietary control of nephritis are well recognized. The Institute is equipped for administering this standard treatment. The therapy of hypertension, whether pure or associated with nephritis, is generally regarded as unsatisfactory. The diet treatment used in this Institute is different from the ordinary, and is believed to be more successful. Though early or mild cases are naturally most promising for prophylaxis and for complete return to normal, it is possible in the majority of advanced cases to obtain marked and long-lasting benefits in the form of reduction of pressure and relief of symptoms. Physicians are invited to refer cases to the Institute for proof of this statement.

Obesity

The Institute offers treatment for any kind or degree of obesity. When the patient is willing to cooperate reasonably in diet, any desired reduction of weight can ordinarily be accomplished without danger and without serious privation. This statement applies also to the so-called endocrine type of obesity.

THE PHYSIATRIC INSTITUTE

FREDRICK M. ALLEN, Director

BOUGIES DRAINS

CATHETERS

Standard and Special Models

Ureteral Catheters and Bougies a Specialty

Insist on

"EYNARD"

The best that can be produced by expert workmen and careful selection of material

Ask your dealer

C. R. BARD, Inc.
37-39 East 28th St., New York

(Continued from page 48)

Dr. Edwin D. Watkins has been appointed as Associate Editor of the Memphis Medical Journal, replacing Dr. James B. Stanford, retired.

Dr. W. J. Breeding, Sparta, has been appointed Acting Director of the Division of Venereal Disease Control of the State Board of Health.

Dr. Benjamin T. Terry, Professor of Pathology, Vanderbilt University School of Medicine, Nashville, has been appointed Director of Pathologic Laboratories at the Toledo Hospital, Toledo, Ohio, effective September 1.

Dr. Thomas David Moore and Miss Ruth Frazer Brown, both of Memphis, were married March 18.

Dr. H. William Hundling, Memphis, and Miss Rebecca Burnett, Birmingham, Ala., were married March 10.

Dr. Louis Franklin Boyd and Mrs. Lena H. Graper, both of Memphis, were married March 13.

Deaths

Dr. Riley H. Davidson, Lexington, aged 73, died in March from cerebral hemorrhage.

Dr. Deering J. Roberts, Nashville, aged 84 died March 29.

Dr. William Wood Taylor, Memphis, aged 71, died suddenly recently.

Dr. B. L. McDonald, New River, aged 47, died March 15.

Dr. William Taylor Foute, Lenoir City, aged 80, died in March at a hospital in Knoxville, following an operation for gangrene of the leg.

Dr. Charles Nathaniel Newman, Tullahoma, aged 68, died March 10 from angina pectoris.

Dr. Spencer T. Lucas, Jefferson City, aged 72, died March 21 from pneumonia, following influenza.

Dr. Lafayette Hill, Jr., Covington, aged 74, died March 22 following a long illness.

TEXAS

Harrison County Medical Society has elected Dr. G. P. Rains, Marshall, President; Dr. L. A. Colquitt, Waskom, Vice-President; Dr. R. G. Granbery, Marshall, Secretary-Treasurer.

Nueces County Medical Society has elected Dr. A. H.

(Continued on page 52)

Neosalvarsan

"The Dependable Original"

Made in the United States in strict conformity with Ehrlich's processes and formulas. Government tested.

HA M E T Z LAB

Reg. U. S. Pat. Off.

Our obligation of responsible helpfulness towards practitioner and patient is being fulfilled through the medium of lowered prices of Neosalvarsan possible by quantity production.

I.	0.15 gram	$.60	per ampule
II.	0.3	.65	" "
III.	0.45	.70	" "
IV.	0.6	.80	" "
V.	0.75	.90	" "
VI.	0.9	1.00	" "

HA M E T Z LAB

Reg. U. S. Pat. Off.

Neosalvarsan, the dependable original, is unsurpassed in low toxicity and is unequalled in therapeutic effectiveness. These facts have been demonstrated through extensive use during the past thirteen years and constitute a unique record.

H·A·METZ LABORATORIES, Inc.

Richker's Luer All Glass Syringes Are Good

PRICES ARE VERY LOW

(1) RICHKER LUER SYRINGES are BEST, WHY?
(2) Sterilization Proof Hard Glass.
(3) GRADUATION Markings BAKED in. STERILE Stationary Finger-rests. Bevelled to prevent rolling.
(4) GUARANTEED To Fit Luer STANDARD TIP.
(5) RICHKER'S SYRINGES ARE Guaranteed.
(6) ORDER TODAY and be SATISFIED.

PRICES

1½cc	$ .55	10cc	$1.40
2cc	.65	20cc	2.10
5cc	1.10	30cc	2.50

20% off by the dozen, choice of one size or assorted. Eccentric Tips, add 15% extra.

RICHKER BROS. & CO.
SURGICAL AND ELECTRICAL INSTRUMENTS
403 Fannin Street HOUSTON, TEXAS

In Bronchitis and Tuberculosis

CALCREOSE (calcium creosotate) is particularly suitable as an adjunct to other remedial measures.

CALCREOSE has all the pharmacological activity of creosote and may be taken in large doses for long periods of time.

RADIUMTHERAPY

In the minds of many physicians the use of Radium is associated only with the treatment of malignant disease, but its use in non-malignant conditions actually forms a broader field of usefulness.

Good results are being reported with radium in such conditions as inoperable toxic goiter, certain types of uterine fibroids, uterine hemorrhage, tubercular adenitis, angiomas and many types of subacute and chronic skin lesions.

As a supplementary service, we offer RADON *(radium emanation.)*

RADIUM CHEMICAL CO.
PITTSBURGH, PA.
NEW YORK BOSTON CHICAGO

RADIUM CHEMICAL COMPANY
Forbes and Meyran Aves., Pittsburgh Pa.
Please send me data on radiumtherapy—
M. D.

The Ella Oliver Refuge

A refined Christian home for the care and protection of unfortunate girls during pregnancy and confinement.

Under the auspices of the Women's and Young Women's Christian Associations of this city.

Adoption of babies arranged for when desired.

Patients may have house physician or any other ethical physician.

Charges very reasonable.

Strictest privacy is maintained.

For folder and further information, address

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903 Walker Ave.,
Phone—Walnut 639 Memphis, Tenn.

HIGH POWER
Electric Centrifuges

Send for Cat Cn

INTERNATIONAL EQUIPMENT CO.
253 Western Ave., Boston, Mass.

(Continued from page 50)

Speer, Corpus Christi, President; Dr. G. Wyche, Robstown, Vice-President; Dr. M. J. Perkins, Corpus Christi, Secretary-Treasurer.

Smith County Medical Society has elected Dr. Roy L. Page, President; Dr. J. M. Griffith, Secretary-Treasurer.

Victoria-Calhoun County Medical Society has elected Dr. R. W. Ward, Victoria, President; Dr. A. D. Gibson, Port Lavaca, Vice-President; Dr. J. V. Hopkins, Victoria, Secretary-Treasurer.

Seventh District Medical Society met in Austin, February 19. The following officers were elected: Dr. Summerfield M. Taylor, Austin, President; Dr. W. G. Pettus, Georgetown, Vice-President; Dr. Hugh McKeown, Austin, Secretary.

Tyler's Four-State Hospital and Training School for colored people will soon be built in Dallas. Rev. J. A. Tyler (colored), Dallas, who made this announcement, has been working for the erection of this Hospital since 1922. The four states to be served are Texas, Oklahoma, Louisiana and Arkansas.

A two-story building is being constructed at Littlefield, the lower floor of which will be used as a drug store; the upper floor will contain an operating room and several wards for patients; offices for doctors and dentists.

The House of Representatives recently adopted the Wallace Eleemosynary Bill, which would establish two psychopathic hospitals for the treatment of the curable insane, one at the Medical Department of the University of Texas, Galveston, and the other at Baylor Medical College, Dallas. The bill provided that the directors of these institutions shall receive $7,500 a year.

The Dallas Sanitarium, a Methodist hospital, is being built in Oak Cliff at a cost of $1,000,000. The grounds on which

(Continued on page 54)

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(Continued from page 52)

the hospital is being built consist of twelve acres of land.

The will of Mrs. Marion Morton, Haskell, provides a fund of $50,000 for the erection of the Marion Morton Hospital, as a memorial to her husband.

Dr. Marvin L. Graves, Professor of Medicine and Lecturer on Mental and Nervous Diseases, University of Texas, Galveston, has resigned. He has served the University more than twenty years. Dr. Graves will make his home in Houston.

Dr. Thomas B. Taylor, Bastrop, has been appointed County Health Officer, succeeding Dr. Henry B. Combs, resigned.

Dr. Henkle Garst, Austin, Director Bureau of Child Hygiene, State Department of Health, was recently appointed Director of the Health Unit that the State, in cooperation with the Rockefeller Foundation, established in Nueces County.

Dr. Gavin Watson, Clarksville, was recently appointed Health Officer of Red River County.

Deaths

Dr. William Polk Richardson, Beaumont, aged 48, died February 17 at the Scott and White Hospital, Temple, from pneumonia.

Dr. Josephus Whitley Cavitt, Bryan, aged 71, died February 4 from pneumonia.

Dr. Daniel Herbert Reeves, Burkburnett, aged 32, died March 8 at the Wichita Falls General Hospital, Wichita Falls, from acute articular rheumatism.

Dr. Ralph Thomas Blount, Lovelady, aged 48, died February 18 at St. Joseph's Infirmary, Houston, from pneumonia.

Dr. Sherrod K. Pickens, Winfield, aged 76, died March 10.

Dr. William McKinley Shankle, Chilton, aged 70, died March 11 from heart disease.

VIRGINIA

Lee County Medical Society has elected Dr. C. Pearce, Pennington Gap, President; Dr. J. B. Muncy, Jonesville, re-elected Secretary.

(Continued on page 56)

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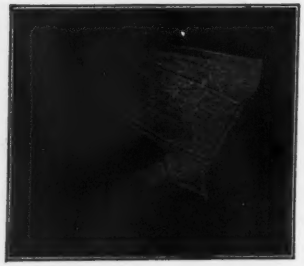

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(Continued from page 54)

The Southside Virginia Medical Association held its regular quarterly meeting in Norfolk March 10.

A contract has been awarded for the erection of a nurses' home in connection with the Virginia Baptist Hospital, Lynchburg, the building to cost approximately $36,000. It will be the gift of O. B. Barker, Lynchburg.

Dr. Frank Helvestine, Jr., is now connected with the staff of Shenandoah Hospital, Roanoke.

Dr. John H. Bell, for several years first assistant to the late Dr. A. S. Priddy, has been elected Superintendent of the Virginia State Epileptic Colony.

Dr. W. Nelson Mercer, formerly with the Bureau of Health of Richmond, is now with the U. S. Veterans' Bureau at Saranac Lake, N. Y.

Dr. J. W. Williams, Irwin, and Mrs. Mary Stamper Rayner, Fredericksburg, were married March 31.

Deaths

Dr. Silas M. Stickley, Stephens City, aged 73, died March 20.

Dr. George Emory Plaster, Berryville, aged 98, died March 5.

WEST VIRGINIA

The American College of Surgeons, Virginia, West Virginia, Maryland and District of Columbia Section, held its annual meeting in Charleston March 20-21. The 1926 meeting will be held in Winchester, Va.

Plans for combining the Lotan and Guyan Valley Hospitals have been consummated. Under the new plan, Drs. L. E. Steels and H. H. Farley, of the Logan Hospital, and Dr. Lawrence Lawson, of the Guyan Valley Hospital, will have complete control, and the recently erected Guyan Valley Hospital will be utilized for the business of the new corporation. The Guyan Valley building will be remodeled at an expense of from $30,000 to $40,000.

Dr. M. W. Sinclair recently became associated with the Bluefield Sanitarium, Bluefield.

Dr. Richard Hardwick, Huntington, and Mrs. Jennie Duncan, Kenova, were married recently.

Deaths

Dr. Isaac Philip Eddy, Williamstown, aged 56, died March 24 at a hospital in Huntington from cerebral hemorrhage.

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